THE NORTH KARELIA PROJECT

20 Year Results and Experiences

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To Dr Ravi Narayan
with great respect and
warm wishes

Geneva 26/7/2001

Pekka Puska

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"When Finland is oppressed, then anguished Karelia mourns for the nation; yet when the happy days dawn over our land once more, then joy and much music burst forth from Karelia"

(Karelian anthem, 3rd verse)

PREFACE

The aim of this book is to present a comprehensive picture of the activities, results and experiences that have taken place in and around the North Karelia Project during its 20 years of existence. The project was initiated to reduce the extremely high mortality from coronary heart disease in Finland, using the province of North Karelia as a national pilot area. Since its initial phases the project has contributed energetically and effectively to the substantial health benefits which have spread across the nation. The scope of the project has also been broadened to integrate other major non-communicable diseases and health promotion measures.

This book is made up of independent chapters by different authors, mostly researchers and experts closely involved with the North Karelia Project. This format has unavoidably introduced a degree of heterogeneity, with several chapters overlapping to some extent. Some chapters deal predominantly with epidemiological findings, while others describe the community-based prevention and health promotion activities and their outcomes. It is thereby the hope that this book is able to serve a somewhat mixed audience of researchers, health policy planners, and experts and field personel involved in chronic disease prevention and health promotion, and to provide a clear and balanced perspective of the project.

Many of the results presented here have already appeared elsewhere among the numerous scientific publications of the North Karelia Project. It is nevertheless hoped that presenting the main findings and experiences in a single volume, along with descriptions of the methods and principal activities, will prove helpful to a large and diverse international audience. Although there exist numerous good textbooks on epidemiology, public health and health promotion, much less has been published on practical programmes that have actually implemented the principles in a systematic and long-term manner, and evaluated the outcomes. We wish to share with the widest possible international audience the wealth of experience we have generated in the field of community-based pre-

vention of modern chronic disease epidemics. Readers are reminded that North Karelia and Finland were forced into early action by the exceptionally grave heath situation which prevailed before the project began.

We are naturally most grateful to all the authors and other people who have contributed to this book. We wish to mention Mr. Richard Burton in particular for his careful editing of the English language, as well as Dr. Pekka Jousilahti and Ms. Ulla Uusitalo, MSc. (Nutr.) for their editorial assistance. We also would like to thank Ms Marketta Taimi and Terttu Malkamäki for their assistance in preparing the numerous figures and tables in this book.

This is an ideal opportunity to express our gratitude to all the sponsors of the North Karelia Project over the years, especially the Finnish authorities. It needs to be stressed that the succesful implementation of the project was only made possibly by the willing and active participation of all sectors of the North Karelian community – including the citizens themselves.

We wish to express our thanks to the numerous international collaborators who have contributed so much to the scientific and public health work carried out in the project. We are particularly indebted to the World Health Organization for its contribution over the years. Finally, we are grateful to Finland's National Public Health Institute (KTL) for publishing this book.

Helsinki, 25 September, 1995

Pekka Puska
Jaakko Tuomilehto
Aulikki Nissinen
Erkki Vartiainen

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VI SUMMARY

FOREWORD

Since the Second World War, cardiovascular diseases and some other noncommunicable diseases have been the leading public health problems in Europe. Finland has been unusually hard hit, and Finnish experts and health authorities have naturally been concerned to reverse the situation.

The Regional Office for Europe of the World Health Organization has been closely involved with the North Karelia Project from its very beginning. My predecessor, Dr Leo A. Kaprio, a Finn himself, saw the potential of the project and actively supported its formulation and implementation. After the initial support from WHO, the North Karelia Project has actively participated in and, indeed, made major contributions to many WHO programmes.

The North Karelia Project participated in the 1970s in many WHO programmes in the field of cardiovascular disease epidemiology and prevention. But above all, the project was the driving force behind the Comprehensive Cardiovascular Community Control Programme (CCCCP). The main principles of this programme were outlined at a WHO meeting in Koli, North Karelia in 1976 and its main achievements were published in a WHO Regional Office report in 1988, edited by Professor Pekka Puska. In the early 1980s, the main report of the original North Karelia Project was also published by the Regional Office.

The North Karelia Project has continued to study major long-term effects of intervention, the most remarkable being the reduction in the cardiovascular disease epidemic. At the same time, however, the project has carefully responded to new challenges and needs. The scope of the project has been broadened to include other major noncommunicable diseases and the promotion of health in an integrated way. The North Karelia Project and its director, Professor Pekka Puska, have again been a driving force behind the most recent major Regional Office programme, CINDI (Countrywide Integrated Noncommunicable Diseases Intervention) in which 24 countries presently participate.

The coordinating centre of the North Karelia Project is the National Public Health Institute of Finland (particularly its Department of Epidemiology and Health Promotion), which has for many years been a WHO Collaborating Centre for Community Programmes in Chronic Disease Prevention and Health Promotion. It also hosts the international data centre of the large WHO study on monitoring trends in cardiovascular diseases (MONICA).

In this capacity, the National Public Health Institute and the North Karelia Project team have contributed in many ways to international health development by sharing the Finnish experience. In collaboration with WHO, the project organizes a twice-yearly international visitors' programme that has so far been attended by hundreds of experts and fellows from Europe and other parts of the world. In 1991, the North Karelia Project received the global WHO Health Education Prize in recognition of its achievements.

I hope and believe that this book will help publicize to a wider audience the pioneering experiences of the North Karelia Project, not only in North Karelia itself, but also throughout Finland.

I would like to thank the Finnish National Public Health Institute for its collaboration and congratulate the project team on its achievements. The North Karelia Project exemplifies in practice many of the principles advocated by WHO: careful research, sound health information systems, visionary and innovative interventions, intersectoral collaboration and partnerships and, above all, community mobilization for health.

Copenhagen, 15 September 1995

J.E. Aswall, M.D.
WHO Regional Director for Europe

FOREWORD

Finland grew painfully aware during the 1960s of a massive burden of ischaemic heart disease. International mortality statistics corroborated by the Seven Countries Study showed that Finnish men suffered a higher mortality rate of ischaemic heart disease than anywhere else recorded. Moreover, the mortality was extremely high among young men.

The North Karelia Project began its activities in 1972 as a response to this urgent problem. Out of the deep and widespread concern in the province emerged an understanding of the need for a huge and concerted commitment to reverse the alarming situation. It is interesting to note that other health reforms in Finland took place at the same time, reflecting the general concern throughout the nation.

The North Karelia Project had many challenges to meet. At the time, much less was known about our ability to prevent atherosclerotic cardiovascular diseases in general, quite apart from the relatively novel concept of community-based prevention. But the project was fortunate at least in two ways. Firstly, a young team of dedicated and socially-oriented experts was analyses, whereas nowadays the division devoted to chronic diseases and general health performs an impressive and internationally recognized level and range of activities.

KTL is both pleased and proud that the North Karelia Project and the activities surrounding it have exerted a major impact on heart health in Finland and played a substantial role in the remarkable improvement in the nation's overall public health. Also that the project has contributed in may ways to international developments in the field of chronic

disease epidemiology and prevention and health promotion. In this context we wish to acknowledge the vital role of the World Health Organization and are pleased at our collaboration for this important report.

Helsinki, 12 October, 1995

Jussi Huttunen
Director General, National Public Health Institute (KTL), Finland

I

Background and General Principles

1. PREHISTORY OF THE NORTH KARELIA PROJECT

Martti J. Karvonen

In Finland, "heart stroke" (apoplexia cordis) was already a commonly recorded cause of death back in the 19th century. It occurred in both sexes and was not exclusive to the elderly. Angina pectoris was the dreaded premonitor of heart stroke.

Coronary heart disease as a diagnostic entity became firmly established in medical clinics during the 1930s. In 1947 a young demographer, Väinö Kannisto, published his doctoral thesis on mortality in Finland, pointing out that mortality in eastern regions of the country had been higher than in the west since the 19th century, and that heart disease deaths there were particularly common (Kannisto 1947). In fact, rates for eastern Finland headed the international league table of heart disease mortality. I was one of those who read the short review of Kannisto's thesis in the Finnish medical journal "Duodecim". My curiosity was aroused.

Back in 1945, as a junior demonstrator in the Institute of Physiology at Helsinki University, I had accepted the somewhat perilous challenge of organising physiological studies in connection with the National Championships for Lumberjacks, which involved the men in felling and cutting trees over four days – all with hand saw and axe. Work physiology and occupational health became the focus of my career from 1950 on. In those days forestry was the dominant occupation in the eastern regions of Finland where cardiovascular mortality was highest. This was despite the fact that physical activity and sports were already reputed to enhance health and prolong life. That something was seriously amiss in current scientific understanding was becoming increasingly obvious to the young physiologist, by now at the Institute of Occupational Health.

On my first journey to the United States in the spring of 1954 I visited the Laboratory of Physiological Hygiene of the University of Minnesota in Minneapolis. I had a short discussion with its director, Ancel Keys, who had just returned from visiting Italy. In 1952 he had published his hypothesis on the chain of causation: dietary fat – high blood plasma cholesterol – atherosclerosis, and its clinical manifestations in the cardiovascular system (Keys 1952). This encounter provided the decisive stimulus to our joining forces in 1956 for the first East-West study of coronary risk factors.

Two areas of Finland with contrasting mortality were selected: one in the east and the other in the southwest. Clinically healthy men and women were examined, and habitual family diets subjected to intensive study. The results appeared to support the cholesterol hypothesis: dietary intakes of saturated fats, as well as serum cholesterol values, were high by international standards, and both were higher in the east than in the southwest (Keys et al. 1958, Roine et al. 1958).

The experiences gained in these cross-sectional surveys were sufficiently encouraging to add a time dimension. Thus began the longitudinal study of two contrasting populations of men aged 40–59 years at entry – one in the east and the other in the southwest, as before. Both the five and 10-year follow-ups confirmed the marked east-west disparity in coronary risk. This East-West project began in 1959 as a component of the unique "Seven Countries Study", where the same cohorts of men have continued to be examined at regular intervals, allowing their coronary heart disease incidence and mortality to be monitored for 25 years and beyond.

In Finland the 30-year follow-up examination of these cohort survivors took place in 1989, and their hospitalizations and mortality are still being recorded, at least up to 40 years. In the course of the East-West study several potential contributors to the risk were examined in addition to diet and serum cholesterol, viz. blood pressure, smoking habit, salt intake, trace elements in water, habitual physical activity, thyroid antibodies, childhood environment, war experiences, and recent life changes (Kromhout 1994).

It is one thing to identify the cause(s) of a disease – quite another to prevent it. Planning for a medium-scale experiment in dietary prevention started in 1957, and a 12-year cross-over experiment involving die-

tary fats was launched in two Finnish mental hospitals in 1960. These efforts quickly prompted the development of expertise for modifying typical Finnish diets with acceptable substitutes for milk and butter.

By replacing dairy fats in milk by soybean oil, and butter by a soft margarine with a high content of polyunsaturated fatty acids, the trial resulted in a radical change in the P/S ratio (polyethenoid/saturated fatty acids) of the hospital diets: from 0.25 to 1.48 on average over the entire duration of the open-cohort experiment. Serum cholesterol levels responded with a sizable average decrease in men from 267 to 226 mg/dl (6.90 to 5.84 mmol/l), and in women from 275 to 249 mg/dl (7.11 to 6.20 mmol/l) over the study period. Moreover, the incidence of coronary heart disease tended to diminish in both men and women (Turpeinen et al. 1960, Turpeinen et al. 1979, Miettinen et al. 1983).

As research on risks and prevention gathered pace, the issues began to be 'taken to heart' by a wider public. The Finnish Heart Association, founded in 1955, was the first to emulate its American counterpart, established way back in 1924. Right from the outset the Finnish Heart Association attracted support from health authorities and various social and political leaders, enabling it to smooth the path for research and the application of study findings. It also rapidly developed a field organization, whose regional branch members in North Karelia were always eager for fresh information from the East-West study. The investigators reported the findings from eastern Finland at the annual Heart Association meetings, which were also attended by regional leaders.

In response to the summary and conclusions from the 10-year follow-up in 1970, the Regional Governor of North Karelia, Esa Timonen, invited all North Karelian members of the Finnish parliament and several representatives of official and voluntary organizations to form a pressure group. A petition for state aid to reduce the cardiovascular problem in North Karelia was signed on January 12th 1971. The governor headed the delegation which took the petition to Helsinki, where it was presented to the Finnish Government, the National Board of Health, the Medical Research Council of the Finnish Academy, and the Finnish Heart Association. Publicity was generated and action promised.

The Finnish Heart Association was the first to act, by convening a special working group for the task. This group conceived a basic plan for the North Karelia Project, and the association appointed two full-

time physicians to work out the details. The working group concluded that leadership of such a project was not a task appropriate for senior medical professionals likely to be preoccupied with other work, but was rather a make-or-break challenge for a younger candidate. In 1972 Dr Pekka Puska was appointed as Principal Investigator. Dr Puska thoroughly immersed himself in the North Karelia Project from the outset, has persisted with it throughout, and deserves much of the credit for its resounding success.

Two institutions also deserve a mention. The Finnish "home" of the East-West Study was the Helsinki Institute of Occupational Health, founded in 1951, a facility which offered novel approaches and a broad spectrum of research and services. The institute soon established close contacts with the World Health Organization (WHO). Cardiovascular diseases entered the programmes of WHO in the early sixties, first via the Regional Office for Europe in Copenhagen, and later at WHO Headquarters in Geneva. There was mutual interest in preventive cardiology, and close professional and personal ties developed between the WHO staff members responsible: initially Mikhail Akhmetely, then Zbynek Pisa in Copenhagen and Zdenek Fejfar in Geneva.

For WHO, the concept of the North Karelia Project was a logical step towards the realization of shared ideas, and a welcome opportunity for the practical testing of prevention in the community. To assist finalization of the detailed plan at the planning seminar held in Joensuu on September 7–9th 1971, WHO contributed four international experts: Z. Fejfar, WHO, Geneva; J.N. Morris, London; Z. Pisa, WHO, Copenhagen; H. Blackburn, Minneapolis.

The old East-West Study continued its observational research in Ilomantsi as before, while the new North Karelia Project was to become a broad-spectrum community intervention covering the entire North Karelia Province. For the Ilomantsi cohort of men the contrasting southwest was the comparison area, while the North Karelia Project selected the neighbouring province of Kuopio as its primary initial reference area.

In summary, the North Karelia Project was a logical, yet courageous stride forward based on the results and inferences of the East-West Study (Karvonen et al. 1970, Keys et al. 1980).

REFERENCES

Kannisto V. Kuolemansyyt väestöllisinä tekijöinä Suomessa. Kansantaloudellisia tutkimuksia 15. Helsinki 1947.

Karvonen MJ, Orma E, Punsar S, Kallio V, Arstila M, Luomanmäki K, Takkunen J. Five-year experience in Finland. In Keys A (edit.). Coronary Heart Disease in Seven Countries. Circulation 1970; Suppl 1:52–62.

Keys A. The cholesterol problem. Voeding 1952;13:539–555.

Keys A, Aravanis C, Blackburn H, Buzina R, Djordjevic BS, Dontas AS, Fidanza F, Karvonen MJ, Kimura N, Menotti A, Mohaček I, Nedeljković S, Puddu V, Punsar S, Taylor HL, van Buchem FSP. Seven Countries. A Multivariate Analysis of Death and Coronary Heart Disease. Harvard University Press, Cambridge Mass. 1980, 381 pp.

Keys A, Karvonen MJ, Fidanza F. Serum cholesterol studies in Finland. Lancet 1958;2:175–178.

Kromhout D, Menotti A, Blackburn H (eds). The Seven Countries Study. A Scientific Adventure in Cardiovascular Disease Epidemiology. Brouwer Offset bv. Utrecht, The Netherlands. 1994.

Miettinen M, Turpeinen O, Karvonen MJ, Pekkarinen M, Paavilainen E, Elosuo R. Dietary prevention of coronary heart disease in women: The Finnish Mental Hospital Study. Int J Epidemiol 1983;12(1):17–25.

Roine P, Pekkarinen M, Karvonen MJ, Kihlberg J. Diet and cardiovascular disease in Finland. Lancet 1958;2:173–175.

Turpeinen O, Karvonen MJ, Pekkarinen M, Miettinen M, Elosuo R, Paavilainen E. Dietary prevention of coronary heart disease: The Finnish Mental Hospital Study. Int J Epidemiol 1979;8(2):99–118.

Turpeinen O, Roine P, Pekkarinen M, Karvonen MJ, Rautanen Y, Runeberg J, Alivirta P. Effect on serum-cholesterol level of replacement of dietary milk fat by soybean oil. Lancet 1960;1:196–198.

2. MAIN OUTLINE OF THE NORTH KARELIA PROJECT

Pekka Puska

1. INITIATION AND PLANNING

The background of the North Karelia Project is described by Professor Karvonen in the previous chapter. In the late 1960s the emerging Western epidemic of cardiovascular diseases, and their exceptional prevalence in Finland, began to alert widespread public concern. This was fuelled by media reports and research findings drawing particular attention to Finland's eastern region. In addition, the studies of Karvonen, Keys and others had begun to focus on the possible role of certain "risk factors".

After the petition of January 1971, described earlier, the Finnish Heart Association set up a planning group including several Finnish experts, and contacts were established with WHO. At the large planning seminar in September 1971, the main principles of the North Karelia Project were formulated and further steps recommended.

The initial organization of the North Karelia Project was composed of a board of directors (chaired by the Governor, Esa Timonen), a steering committee (chaired by the County Medical Officer, Väinö Soininen), a principal investigator (Pekka Puska), and a co-ordinating centre (initially at the University of Turku, but shortly relocated to the University of Kuopio). The project organization members further elaborated and refined the plans.

It was quite obvious even during this planning phase that any major control of cardiovascular diseases in North Karelia would be largely dependent on the potentials for primary prevention. Findings from the Seven Countries Study, the Framingham Study and others had already suggested the important causal role of certain risk factors. While several trials were being planned to "prove the causality", it was also being pointed out that the risk factors were very closely linked with community life-

styles. This was certainly the case in North Karelia, where the pervasiveness of the main risk factors was clearly related to the generally unhealthy diet and smoking habits etc.

These considerations, combined with the historical background, guided the formulation of a community-based intervention strategy. The central task became to shift the risk factor profile of the entire North Karelian population through a community-based intervention: "A mass epidemic calls for mass action and the changing of lifestyles can only succeed through community action".

In the process of outlining these intervention principles, the team was aware of the importance of carefully evaluating the results and experiences. It was felt that only the most thorough scientific evaluation would allow the project to contribute to our knowledge of how to modify risk factors in a population and whether this can really lead to reduced disease rates. The "evaluation study design", described later, was the outcome of these deliberations.

Thus was launched the world's first major community-based preventive study in the field of CVD.

It was stressed that sound evaluation of the findings and experiences in North Karelia would allow this approach to benefit the whole country, and perhaps others, too. So the North Karelia Project was seen both as a "pilot" and a "demonstration" project for Finland as a whole.

The original North Karelia Project was planned for a five year period. In January 1972 a large baseline survey was launched in North Karelia and its matched reference area (the neighbouring province of Kuopio); large representative population samples were involved, as well as carefully standardized methods.

The baseline survey was completed in April 1972, by which time the more detailed plans for the intervention were ready. The various features and elements of the planning (e.g. community diagnosis) are described later. On World Health Day, April 7th, the intervention was announced, and several monitoring systems (disease registers) were activated soon afterwards.

The planning of the project, its initial progress during the first five years, as well as numerous relevant background features, are described in the WHO monograph "The North Karelia Project in 1972–77" (Puska et al. 1981).

2. NORTH KARELIA

Finland is a republic in northern Europe whose population of about 5 million is relatively homogenous by international standards. Finland has evolved into a modern welfare state since emerging from the devastating experiences of World War II.

North Karelia is one of the country's 11 provinces (counties), running along part of the eastern border with Russia (the Soviet Union until 1992). It is approximately 20.000 km in size and characterized by large tracts of forest, hilly terrain and numerous lakes.

North Karelia's population has remained stable at around 180.000 for the past 20 years. People live in the countryside, in smaller towns, or in Joensuu the provincial capital. The main sources of livelihood used to be agriculture and forestry, but their importance has declined sharply since the 1960s and it is now industry and the service sector which predominate.

All provinces in Finland are divided into local authority districts, of which North Karelia has 19. These municipalities provide and operate schools and health and other welfare services according to central statutory requirements, mainly using revenues from municipal and state taxes.

Since 1972 the bulk of primary health care in North Karelia (as in Finland as a whole) has been dispensed at the fairly comprehensive municipal health centres spread around the province. These employ general practitioners, public health nurses, dentists etc. and have small wards attached. Most specialized medical care is provided at the central hospital in Joensuu.

Judged by numerous criteria, North Karelia has had the lowest socioeconomic status of any Finnish province for the past 20 years. However, as in the rest of the country, there was substantial expansion in the economy and welfare services during the 70s and 80s. These developments have been reasonably homogenous across Finland, largely thanks to relatively centralized policies.

3. OBJECTIVES OF THE PROJECT

The objectives of the North Karelia Project were derived from the background described. The general aim was to perform a community-based health intervention for the benefit of the citizens of North Karelia, and to generate new knowledge and experiences for utilization throughout Finland and elsewhere.

A hierarchy of objectives was developed, as described in greater detail later. Towards the end of the first ten years (1972–82), these objectives were expanded to satisfy local needs and complement international developments (particularly within WHO).

Main objectives

1) Initially (1972–82): to reduce CVD mortality in the local population
2) Later (1982 onwards): to reduce major chronic (non-communicable disease) mortality and promote health in the local population.

Intermediate objectives

To reduce the levels in the local population of the main risk factors and to promote secondary prevention.

Main target risk factors: smoking, elevated serum (LDL) cholesterol and elevated blood pressure. Major emphases on general lifestyle changes (especially smoking and dietary habits).

National objective

1) Initially (1972–77): as a pilot project for the whole of Finland
2) Later (1977 onwards): as a national demonstration project and model programme

In the CVD category, most of the emphasis was placed on coronary heart disease (CHD), but cerebrovascular stroke was also an important specific target. When other chronic diseases were later included, cancers (especially those possibly influenced by smoking and diet) were a particular concern.

Most of the emphasis was on the working age population – especially the men. This was because of the remarkable excess of CVD mortality among middle-aged men. It was also thought that relatively rapid

results in the community could be achieved in this population sector and that these people have the greatest influence in community change. Since then, more systematic emphasis has been devoted to children and youth, and also to older folk.

The intervention methods and actual programme were developed from these objectives and background features by the application of various theoretical frameworks and practical considerations, as explained later.

4. PROJECT EVOLUTION OVER 20 YEARS

The following summarizes some of the main developments during the North Karelia Project:

1971: – petition
– initial planning and project organization

1972: – baseline survey in North Karelia and reference area (Kuopio)
– finalizing of intervention and monitoring plans
– launch of the intervention

1972–77: – comprehensive community-based CVD prevention in North Karelia (initial media campaigns, involvement of various community organizations and health services, mobilizing lay leaders and the public etc.)

1977: – 5-year population survey in North Karelia and Kuopio

1977–82: – continuation of the project in North Karelia: integration of activities within the community structures, introduction of novel elements (especially youth interventions)
– start of national activities and involvements (TV programmes, health policy etc.)

1982: – 10-year population survey in North Karelia and Kuopio and a similar survey in southwest Finland (with WHO/MONICA)

1982–87: – continuation of the demonstration area activities in North Karelia and of national activities in the framework of WHO/CINDI and INTERHEALTH programmes (integrated

prevention of major chronic diseases and promotion of health)

1987: – 15-year population surveys in North Karelia, Kuopio and southwest Finland

1987–92: – continued activity in North Karelia and nationally, but with major emphasis on reinforcing CHD prevention through cholesterol lowering dietary changes (intensified collaboration with food manufacturers)

1992: – 20-year population surveys in North Karelia, Kuopio, southwest Finland and metropolitan Helsinki (thus follow-up of the North Karelia Project progressively evolved into a national risk factor monitoring system)

1992–97: – continued activity in North Karelia and nationwide to ensure and demonstrate further successes.

Over this period the project organization was modified to reflect actual developments. The work of the board of directors and steering committee was completed, and the project further integrated with appropriate organizations, resulting in more operational flexibility for the core project team.

Coinciding with the reorganization of the National Public Health Institute (KTL) in 1980, the co-ordinating centre of the North Karelia Project moved in 1980 from the University of Kuopio to KTL headquarters in Helsinki (at the Department of Epidemiology and Health Promotion). This ensured much greater stability in terms of basic resources, as well as providing an appropriate site for long term monitoring and evaluation, and (under the Ministry of Social Affairs and Health) a useful location from which to disseminate experiences throughout the country.

At the same time the project office in Joensuu was expanded. It remained affiliated with the provincial health department, but assumed a far more active role in various media-related activities, and in "social marketing", community partnerships, etc.

The core project administration is depicted in Figure 1.

Key individuals involved during the 20 years of the North Karelia Project are as follows:

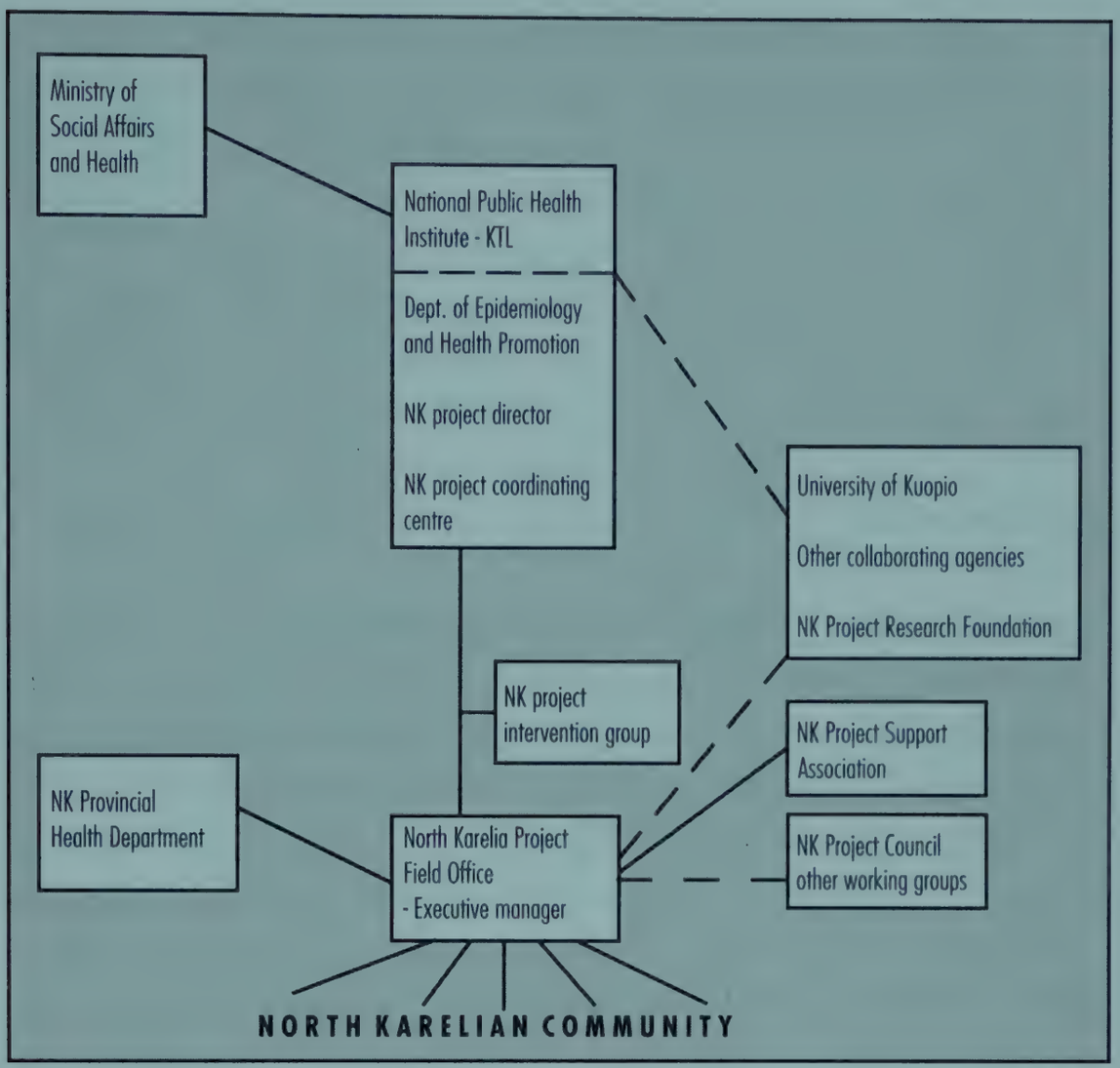
Ministry of Social Affairs and Health
National Public Health Institute - KTL
Dept. of Epidemiology and Health Promotion
NK project director
NK project coordinating centre
University of Kuopio
Other collaborating agencies
NK Project Research Foundation
NK project intervention group
NK Project Support Association
NK Provincial Health Department
North Karelia Project Field Office - Executive manager
NK Project Council other working groups
NORTH KARELIAN COMMUNITY

Figure 1. Simplified scheme of North Karelia Project administration

– Principal Investigator:	Pekka Puska	1972–
– Project Director	Pekka Puska	1978–
– Co-principal Investigators	Jaakko Tuomilehto	1972–
	Aulikki Nissinen	1977–
	Jukka T. Salonen	1977–82
	Erkki Vartiainen	1987–
– Project Co-ordinator:	Heikki J. Korhonen	1982–
– Executive Manager of the Field Office:	Vesa Korpelainen	1986–
– Governor of North Karelia:	Esa Timonen	1972–92
– Director General of the National Public Health Institute:	Jussi Huttunen	1978–
– Director of North Karelia Provincial Health Department:	Ismo Helenius	1972–

– County Medical Officer of North Karelia:	Väinö Soininen	1972–78
	Pertti Puhakka	1978–
– Chief, Department of Internal Medicine, North Karelia Central Hospital	Helge Honkapohja	1972–80
	Harri Mustaniemi	1980–92

REFERENCES

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J, Björkqvist S, Koskela K, Neittaanmäki L, Takalo L, Kottke TE, Mäki J, Sipilä P, Varvikko P. The North Karelia Project: Evaluation of a comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland 1972–1977. Copenhagen, WHO/EURO, 1981.

3. GENERAL PRINCIPLES AND INTERVENTION STRATEGIES

Pekka Puska

1. BACKGROUND

Cardiovascular and other non-communicable diseases (NCDs) form the major health burden in the industrialized countries and are a rapidly growing problem elsewhere. But at the same time they represent the area where the greatest health gains can be achieved. In most of the developed world three out of four deaths are due to cardiovascular disease, cancer, and accidents and other violent causes. As far as morbidity is concerned, disorders such as diabetes, hypertension, chronic respiratory disease, osteoporosis and some musculo-skeletal disorders are also major problems.

Extensive medical research over the past few decades has probed the causes and mechanisms of these non-communicable diseases. There have been large epidemiological studies within and between populations, basic biochemical and animal studies, intervention trials, and large-scale community-based preventive studies. Findings from this research have indisputably revealed that these NCDs, or events leading to them, have their roots in unhealthy lifestyles or adverse physical and social environments. The major lifestyle factors implicated are unhealthy nutrition, smoking, physical inactivity, excess use of alcohol, and psychosocial stress.

Although there is still much to learn, we have already accumulated a wealth of knowledge for effective preventive action. Actually, so much is now known that the main question in chronic disease prevention is no longer "what should be done?", but "how should it be done?". So the key issue is how best to apply our existing knowledge to effective prevention in real life.

Carefully planned community programmes like the North Karelia Project represent important efforts towards solving this problem. The

gaping contrast between existing medical knowledge and the situation in everyday society stems from a host of formidable obstacles to healthy change – cultural, political, economic, psychological, and so on. The aim of community programmes is to build a bridge for people and communities to overcome these obstacles, or at least to minimize them.

There is another powerful argument in favour of community-based preventive programmes: the source of the mass epidemics of NCDs is unhealthy lifestyles, which often first emerge during periods of economic transition. Large portions of society are under at least some risk, so major reductions in disease rates call for widespread changes in the related lifestyles. Moreover, since these are embedded in the community in complex ways, major lifestyle changes are only possible if their determinants in the community are somehow modified.

Identification of the main risk factors in the early 70s prompted moves towards preventive studies and other efforts, including major community-based preventive programmes. The North Karelia Project was launched in 1972, becoming the first ever major community-based project for CVD prevention. It was soon followed by several similar projects. Activities in Europe were coordinated by WHO/EURO under the Comprehensive Cardiovascular Community Control Programmes ("CCCCP"). The experience was evaluated and published (Puska 1988).

In the early 1980s discussion and planning began to focus more on integrated community programmes for chronic disease prevention. This derived from the observation that the principal risk factors/unhealthy lifestyles usually appeared to be related to several chronic diseases ("common risk factors"). In addition, efforts in the community to prevent different types of disorder needed to be integrated. In the European WHO Region this led to initiation of the Countrywide Integrated Noncommunicable Disease Intervention (CINDI) Programme of WHO/EURO. To date, more than 20 countries are involved, and several other programmes are associated with CINDI.

2. GENERAL PRINCIPLES

A central aim of carefully evaluated community programmes like the North Karelia Project is to forge broad links between basic medical re-

search and the large-scale application of public health programmes. They are thus well-planned, theory-based attempts to overcome the many obstacles to healthy changes and to bridge the gap between medical knowledge and real life situations. A well-monitored programme can thus diminish our uncertainty about the effectiveness of such an approach, inform us about the usefulness of different methods, teach us effective use of the existing resources (services and other community facilities), and reveal any unexpected outcomes. A carefully evaluated community programme serves thereby not only its target area, but also as a study or "demonstration" for wider applications.

Interventions for a community-based intervention study or major demonstration programme need to be well-conceived, and planned and implemented in a systematic manner. The content is determined by the intelligent application and adaptation of existing medical, epidemiological, behavioural and social knowledge to local community settings and situations. Careful monitoring is essential for assessing the usefulness of the intervention for national or other applications.

It needs to be emphasized that even when the framework of an intervention is well-defined and structured on objectives, theoretical frameworks, local community diagnosis and practical considerations, the actual implementation must be flexible enough to respond to changing community situations and to take advantage of any fresh opportunities that arise. Such flexibility has been a strong feature of the North Karelia Project.

The objectives of the project evolved from the public health needs of the community and the intervention strategies were designed using relevant theoretical considerations. Moreover, the project leaders and staff genuinely immersed themselves in the community and among the people, where they developed and adjusted programme activities according to the available local options and circumstances.

A key feature of any community health programme is that it simultaneously applies medical and epidemiological knowledge to identify health problems and target risk factors for selecting intervention objectives, as well as behavioural and social knowledge for designing the actual programme content and activities. This requires interdisciplinary activity throughout the planning and implementation phases, and during the evaluative research.

As previously stated, the general objective of an integrated community-based chronic disease programme is to reduce the rates of major chronic diseases in the community. The intermediate objectives are to reduce the population levels of the main established risk factors. Improvements in early detection, treatment and rehabilitation can also be included in the intermediate objectives. What is needed is thus a strategy that integrates several innovative intervention approaches into a practical programme, which is then itself integrated into the service structure and other local social organizations. The programme must be founded on intersectoral activity, community organization and grassroots participation.

Figure 3/1 describes the hierarchy of objectives in a community programme such as the North Karelia Project. The general aim or goal is improved health and well-being of the population. The main objectives concern the reduction of specified NCDs. The choice is dependent on local mortality/incidence/prevalence rates and on public concerns.

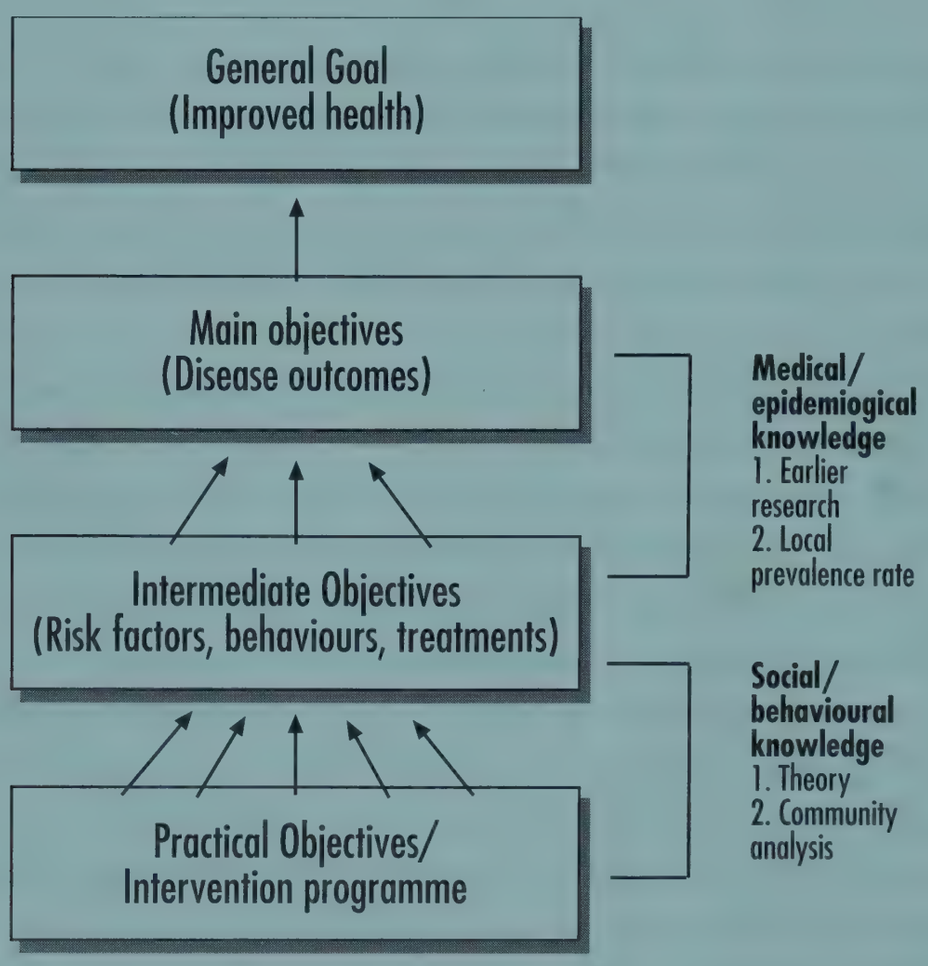

Figure 3/1. Hierarchy of Objectives in a community health programme

After the main objectives have been selected, the intermediate objectives are defined. These are derived from the medical/epidemiological/knowledge in the literature relating to the well-established risk factors for the diseases in question, and from the local prevalence rates of those factors. Clear definitions of the main and intermediate objectives are needed in order to decide on the respective indicators and data sources for monitoring and evaluation.

After the intermediate objectives have been settled the immediate objectives or practical programme contents are decided upon. Because the overall task largely concerns the influencing of health behaviours and related lifestyles, behavioural and social theories are required. A sound understanding of the community ("community diagnosis") is also essential, so all practical potentials and opportunities to this end should be pursued.

3. EPIDEMIOLOGICAL/MEDICAL FRAMEWORK

The main health goal of controlling CVDs, or chronic diseases in general, implies the application of all appropriate action to reducing the burden of disease, including primary prevention, treatment, rehabilitation and other secondary prevention, and related research. However, major success in controlling a chronic disease can only be based on primary prevention, since intervention during the clinical stages of the disease has merely a limited impact. The greatest potential for controlling most NCDs lies in primary prevention; in other words, a "mass epidemic" should be tackled by "mass prevention".

In primary prevention the choice of the main risk factors to be intervened in is derived from the international literature. Smoking, dietary factors and physical activity occupy the main focus. This information then has to be matched with data on the prevalence of these factors in the target population.

In the case of the North Karelia Project this aspect was relatively easy. Back in the early 70s several studies, along with their international conclusions, had identified three main CVD risk factors: elevated serum cholesterol, elevated blood pressure, and smoking. The roles of other possible factors (physical inactivity, obesity, psychosocial stress, alcohol

consumption, micronutrients etc.) were more ambiguous. This was in line with the available information even before the project's baseline survey: serum cholesterol and blood pressure levels, as well as smoking rates, were all very high in the North Karelian male population, while many of the more speculative risk factors (e.g. physical inactivity, obesity) were not particularly prevalent.

Once risk factors have been agreed upon, a programme's intervention strategy can be chosen. The "high risk" (or "clinical" or "focused") approach attempts to identify those people with high risk factor levels and to intervene in them. By contrast, the "community" (or "population" or "public health") approach attempts to modify the general risk factor profile of the entire population.

Although an individual's CHD risk, for example, increases with rising risk factor levels (a fact obviously relevant in clinical practice), it is essential to understand that individuals with clinically high risk factor levels are responsible for only a small proportion of the disease cases that occur in the community. In fact most cases arise among people with only moderate risk factor elevations (although they usually have several at once), who far outnumber the much smaller numbers of high risk individuals. This phenomenon repeatedly emerged from the data of the project (Kottke et al. 1985).

So from the epidemiological standpoint, major reductions in NCD rates in the community can be achieved only by broad reduction in the levels of the multiple and generally "common" risk factors. This demands community-wide efforts in promoting lifestyles that are likely to impact the common risk factor levels in the population and thereby reduce the NCD rates. Such lifestyle changes are usually likely to be beneficial for a wide range of non-communicable diseases, as well as to be safe, and to promote health in general.

Accordingly, the North Karelia Project involved a population-based strategy from the very outset: i.e. employing general community activities to influence the risk factor profile of the whole population. The theme was to change North Karelia, not merely a restricted number of high risk individuals. In more technical terms, the task was to shift the entire risk factor distribution to the left rather than influencing the "high risk" end of the distribution.

4. THE BEHAVIOURAL/SOCIAL FRAMEWORK

Once a programme to promote healthy lifestyle and risk factor changes in the community has been defined, the task enters the realm of the behavioural and social sciences. Medical practice has long been based on the assumption that after identifying the behavioural agents leading to disease, merely informing the subjects concerned is enough to rectify the situation. Numerous studies and everyday practice show that this is seldom the case. Behaviours are embedded in the social and physical environment in complex ways.

Health related lifestyles are largely determined by social forces and other environmental factors. Efforts towards major progress in influencing disease rates in the community have to contend with the environmental forces and structures. The natural and most effective way of changing a population's risk factor levels is to operate through the community: the entire community rather than its individual members should form the target.

Although the task of influencing people's behaviours and lifestyles lies in the domain of the social and behavioural sciences, a persistent and major problem has been the lack of a unifying theory to serve as a guide. Action-oriented people often feel frustrated by the inability of behavioural and social scientists to tell them what they should do. Despite this, there are sound principles in behavioural and social science to guide our way in planning, implementing and evaluating community-based health programmes. Reference can be made to the old wisdom: "there is nothing so practical as good theory."

The following briefly describes four theoretical, somewhat overlapping frameworks for behavioural change often used and referred to in the North Karelia Project. Finally, a model used in the North Karelia Project is presented that unifies these approaches in a community-based preventive health programme.

BEHAVIOUR CHANGE APPROACH

This social psychological approach deals with the determinants of an individual's behavioural changes, and is based on Bandura's work on the

process of learning (Bandura 1977). New behaviours tend to originate, at least on trial bases, from change exposure to powerful models; external and self-enforcement, plus cognitive control are the consequent determinants of continued new behaviours. This approach includes elements of the classical field theory of Lewin (1951) and the behavioural intention model of Fishbein (1975).

In another report a framework compatible with this approach has been described in greater detail, using examples from the various activities in North Karelia (McAlister et al. 1982). This model emphasizes that programme planning and evaluation should include the following key steps to help individuals modify their behaviour:

1. Improved preventive services to help people identify their risk factors and to provide appropriate attention and services.
2. Information to educate people about the relationship between their behaviours and health.
3. Persuasion to motivate people and promote their intentions to adopt healthy action(s).
4. Training to enhance skills of self-management, environmental control and necessary action.
5. Social support to help people maintain the initial action.
6. Environmental change to create the opportunities for healthy actions and improve unfavourable conditions.
7. Community organization to mobilize the community for broad-ranging changes (through enhanced social support and environment modification) to support the adoption of the new lifestyles in the community.

Step 3, persuasion, is one of the key steps in the model. In the North Karelia Project the credibility of message sources was emphasized (WHO, government, academic expert opinion, health motives etc), as well as various "affective" aspects (references to the petition, "local pride", international interest, etc), and message contents that anticipated counter-arguments and resonated with aspects of the local culture. Persuasion often aims to inspire "community action for change", in which individuals are encouraged to participate not necessarily for their own sake, but for the common good in their own familiar community context

(thus emphasizing incentives beyond those related to their personal long-term disease risk).

As in the Stanford "Three Community Study" (Farquhar et al. 1977), there was great stress placed on efforts to teach practical skills for change, such as smoking cessation techniques and ways of buying and cooking healthier foods. For the latter, close co-operation with the local housewives' association has proven invaluable. Activities have been co-ordinated to provide social support, expand options and availability (e.g. production and marketing of healthier foods), and ultimately to organize the community to function in a heathier mode.

THE COMMUNICATION-BEHAVIOUR CHANGE APPROACH

The task of introducing new behaviours into the community is basically achieved by communicating: through popular media channels and via interpersonal approaches. A project disseminates its messages to the population through the mass media, in addition to maintaining direct communication with various community leaders. Well-documented theoretical backgrounds for this approach are provided by Bandura's social learning theory (1977), the classical communication-persuasion model of McGuire (1969), its modification by Flay et al (1980), and the belief-attitude-intention model of Ajzen & Fishbein (1980).

The North Karelia Project developed a model (Figure 3/ 2), largely in connection with its nationwide TV health education programmes (Puska et al. 1981, 1987), that specifies the various steps of behavioural change: from exposure and attention, through comprehension and persuasion, to action and the maintenance of new behaviours. The model further takes into account factors that affect the communicated message, as well as community-related factors that influence the various steps of behavioural change.

The likelihood of positive outcomes is enhanced by careful attention to the factors specified in the model during the planning of the message, and by monitoring or even actively intervening in these factors in the community as necessary (e.g. by encouraging social interaction).

The task of influencing behaviour through mass communication is made extremely difficult by the complexity of the processes involved.

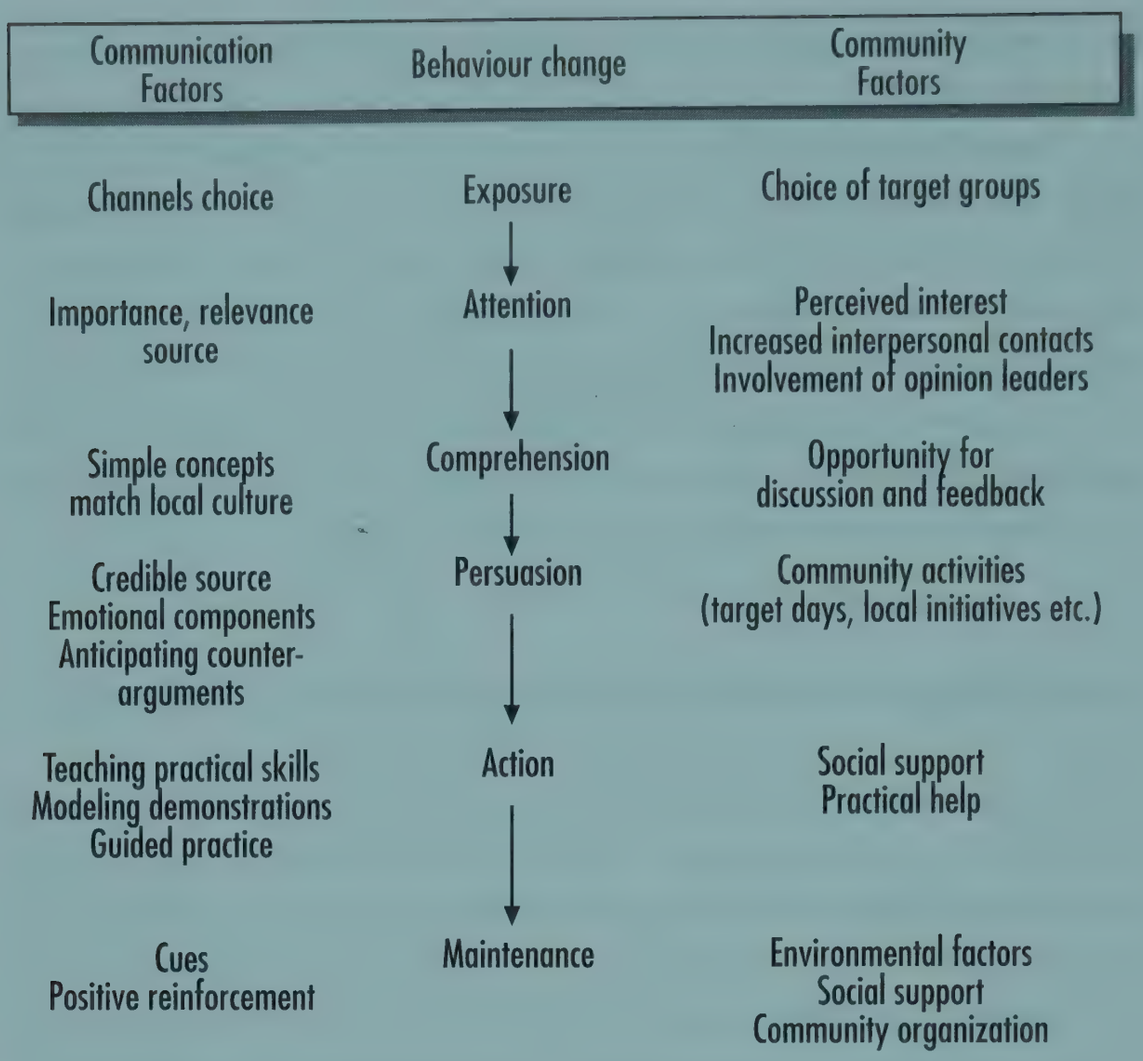

Figure 3/2. Model of communication behaviour change process in community intervention setting, as used in the planning and evaluation of the North Karelia Projects TV programmes

Generally speaking, when people are exposed to numerous and often conflicting messages, as is usually the case, they tend to maintain their established habits. But with well-designed media interventions in appropriate social contexts, significant effects can be achieved. It has been a common experience in the North Karelia Project that such effects may be limited in relative terms, but because of the large audience can be large overall and thus able to generate a very favourable cost-effect ratio.

INNOVATION-DIFFUSION APPROACH

New lifestyles are innovations that diffuse through the natural networks in a community by communication, and gradually lead to social change.

The innovation-diffusion theory argues that while the mass media are more effective in spreading knowledge about innovations and are useful for "agenda-setting" purposes, interpersonal channels are more effective in actually changing attitudes and behaviours. The innovation process occurs in four stages (note the similarity to the previous approach):(a) knowledge, (b) persuasion, (c) decision, and (d) confirmation.

The innovation-diffusion theory classifies people on the basis of their innovativeness: as innovators, early adopters, early majority, late majority, or laggards. The social structure has several norms (system effects) which exert a strong influence on rates of diffusion. Early adoption and a faster diffusion rate are more likely to occur with modern rather than traditional community norms. Early adopters usually have the greatest social influence in the community and are thus in key positions to influence wider adoption of the innovation.

An agent of change can be a professional attempting to influence this innovation-decision process. The three main types of innovation decision are: (a) optional decisions (made individually), (b) collective decisions (by consensus), and (c) authority decisions (by a superordinate power).

These central principles of innovation-diffusion theory were largely developed by Rogers (1983), and complement the classical idea of a two-step flow of new ideas and attitudes through opinion leaders (Katz and Lazarsfeld 1955). The simplified model holds that new ideas, often originating in the mass media, are mediated and modified by certain opinion leaders, and that most people are then mainly influenced by interpersonal contacts with these opinion leaders. Some opinion leaders can be identified by their particular expertise or position, while others cannot be distinguished by such formal criteria. Opinion leaders may either favour or resist a particular innovation-diffusion process.

The principles of innovation-diffusion are of great relevance to many community health programmes. A preventive project, as change agent, attempts to spread certain health innovations through the social network to members of the community by communication. The speed of diffusion is a vital aspect. Diffusion can be facilitated by the skilful application of the theoretical principles of the communication process. The degree of community resistance (system effect) is also obviously important.

Systematic use of the opinion leader theory in the North Karelia Project is described later. In fact, the innovation diffusion theory provided a central framework for the project team. Cigarette smoking and high use of dairy fat were deeply embedded in the cultural lifestyle of the area when the project began. So here, the role of the project as a change agent was to promote the diffusion of the lifestyle innovations of quitting smoking and adopting low fat diets, with the purpose of helping prevent heart disease in individual citizens and the community overall. The theoretical rules of innovation diffusion were applied during the intervention to facilitate the process.

COMMUNITY ORGANIZATION/SOCIAL POLICY

Broad-ranging and permanent changes in the community can ultimately only be achieved through the existing community structures. Every community has a complex network of social organizations, both official and unofficial, that exercise great influence over the behaviour and lifestyles of its citizens.

The community organization approach emphasizes efforts to influence individuals through the modification of organizations. The concept involves community self-development (the community initially detects a problem, then organizes itself to cope with it) as well as the outside influences needed to promote the reorganization.

Community organization strategies are important for effective community-based prevention and health promotion programmes (Bracht 1990). In the case of the North Karelia Project community organization occupied a key position, since the community petition provided a favourable climate for community reorganization. However, the project team provided the external impetus and resources for change in the community, and thus the principles of persuasion and the role of the change agent have been of central importance.

The impact of efforts depends largely on the degree to which existing community organizations regard the proposed actions as suiting their particular needs. Incentives for the proposed collaboration are therefore important in community self-development.

It is vital throughout a programme (but particularly at the start)

that the project team cultivates close contacts with representatives of a great many community organizations. In the North Karelia Project, the team has had close and often personal contacts with professionals in the mass media (newspapers, radio), in health and other services (administrators, doctors, nurses, teachers, social workers, schools, teachers etc), with business leaders (in dairies, sausage factories, bakeries, groceries, etc), with key members of voluntary organizations (heart association, housewives' organization, labour unions, sports associations etc), and with local political decision- makers (provincial and municipal leaders).

Such contacts allow practical and appropriate forms of collaboration to be developed within the context of each organization's particular needs. The obvious aim is for the changes thereby initiated to ultimately influence the general lifestyle in the community. Successful community organization paves the way for social policies favouring healthy change (Milio 1981), a phenomenon repeatedly seen in North Karelia and throughout Finland. The project became associated with healthy public policy in many ways, by contributing to anti-smoking legislation, for instance.

Unified model

The approaches described above are unified in Figure 3 to depict the behavioural/social model of community intervention found to be most relevant for the North Karelia Project. The external input from the project affects the community via mass media communication to the population at large (where its effect is amplified through interpersonal communication), though even more so through the formal and informal opinion leaders associated with various community organizations.

This two-pronged emphasis aims to spread and expand knowledge, to persuade, to teach practical skills, and to provide the necessary social and environmental support for the performance and maintenance of these health skills in the population. The acquisition and maintenance of new behaviours ultimately results in a more favourable risk factor profile, reduced disease rates, and improved health of the population.

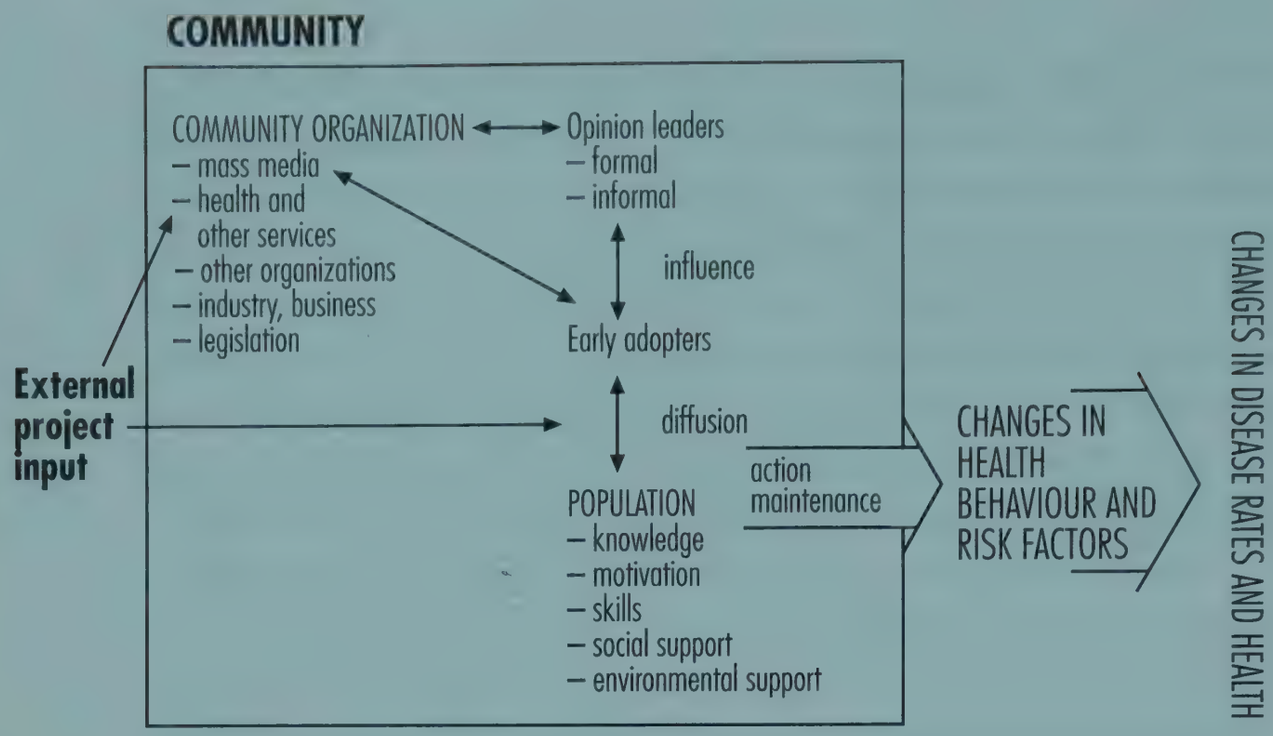

Figure 3.3. Unified model of community intervention, as used in the North Karelia Project.

5. ELEMENTS OF THE PROJECT

The practical framework of a community programme like the North Karelia Project has three components: (1) planning, (2) intervention or programme implementation, and (3) evaluation. Although they ideally occur sequentially, as in the original phase of the project, these elements are often accomplished simultaneously, as was so in the continuation phase.

1. Planning

The prime elements in the project planning are (1) definition of objectives, (2) community analysis, and (3) establishment of the project or-

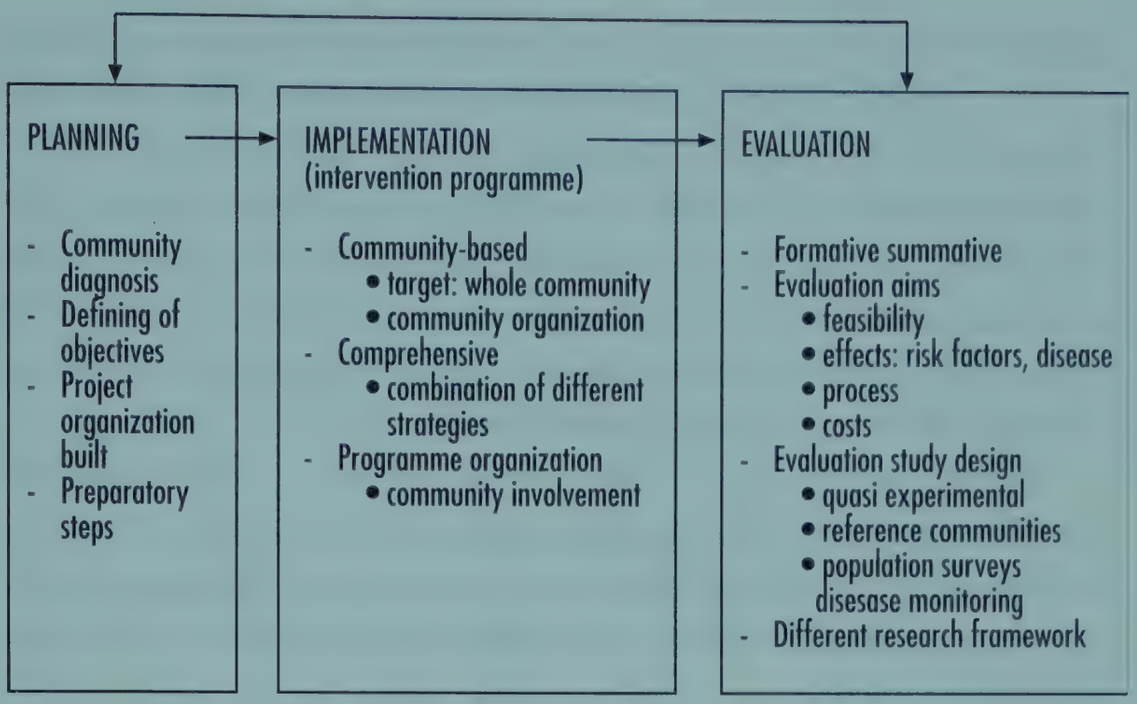

Figure 3.4. The major elements in the community-based project.

ganization and other preparatory steps. The following briefly discusses some major aspects of these elements, with reference to North Karelia.

(1) Definition of objectives

The main objectives of a programme are usually set by the actual and/or perceived health needs of the community. They usually concern the most common and serious NCDs. The intermediate objectives are decided on the basis of the current medical/epidemiological knowledge on how to influence the health problem(s) at issue, and on the local prevalence rates of the risk factors.

Finally, the practical objectives and actual intervention measures emerge from careful analysis of the community and from knowledge of the strategic determinants of the intermediate objectives. The outcome of the analysis is naturally influenced by the choice of theoretical behavioural/social frameworks, as discussed previously.

(2) Community analysis

As far as possible, the community analysis ("community diagnosis") should give a comprehensive understanding of the situation at the start of the

programme (Haglund 1983). It needs to provide the basis for selecting priorities, and particularly for deciding appropriate and effective methods for the intervention. Existing data from previous studies, statistics, and expert opinions should be assembled and reviewed. Later on, the baseline survey findings can be used to complement the picture. Interviewing key local people is vitally important. Special focus groups with representatives in the community can provide invaluable insights into local lifestyles and how they might be influenced.

The community analysis needs to incorporate epidemiological information from the area, i.e. the mortality and morbidity rates of various health problems in the total population and specific subgroups, and the prevalence rates of the factors potentially influencing these disorders in the target population. Certain geographic, demographic and socioeconomic factors should be assessed. Knowledge about the various lifestyles related to the risk factors is needed, as is information on the features of the community which (may) influence these behaviour complexes, on the community leaders and avenues of social interaction/communication, and on other factors relevant to the adopted behavioural/social framework.

Because much of the success of such programmes hinges on the support of the local population, information is needed on how people and their representatives perceive the problems and feel about the possibility of solving them. The programme also needs the co-operation of the local decision-makers and health personnel, so their opinions and attitudes should be surveyed at the outset. In addition, community resources and the service structure need to be considered when working out the actual forms of programme implementation.

(3) Establishment of project organization and other preparatory steps

The establishment of a project organization and the preparatory steps for launching the programme must be carefully planned. The organization needs an enthusiastic and competent leadership, backed up by the appropriate institutional support. Besides possessing the obvious professional skills, the project team must cultivate and maintain good contacts with several important sectors of the community; a broad and relevant

local representation in the organization is essential if the community is to feel a genuine sense of ownership about the project.

The establishment of an integrated NCD community prevention programme extends beyond the usual health care activities. It involves official bodies other than health authorities and has to be founded on a major policy decision. Since such a programme contains many societal and political components, its strategic and tactical features must be shaped to accord with the local epidemiological, health care and sociopolitical situation.

The following steps and elements are an essential part of a programme plan. For each, the best (or alternative) solutions which are feasible for each community should be elaborated in detail:

- making initial decisions and commitments
- choosing the community (if not given for historical reasons)
- establishing societal bases and intersectoral collaboration
- initial funding commitments and plans
- establishing the project team and the focal point(s)
- establishing the steering committee and other management
- ensuring the collaboration of the medical community
- building up intersectoral collaboration, partnership and community involvement.

2. Implementation of the intervention programme

The goal is to systematically implement the programme according to its aims and principles. Within the overall framework, actual implementation needs to be sufficiently flexible to adjust to any unforseen opportunities arising in the community.

Integrating the programme into local society is important because it strengthens community participation and improves the availability of community resources. Thus while the project team usually sets the objectives and develops the general framework, practical activities are carried out mainly by citizens, groups and organizations in the community. The programme catalyses this work by providing materials, training, the necessary official support, media involvement, and follow-up.

Programme activities are usually simple and practical in order to facilitate their enactment by the widest spectrum of the community. Rather than highly sophisticated services for a few people, simple basic services are generally provided for the largest possible stratum of the population. This eases information dissemination and personnel training. Integrating the intervention measures not only conserves project resources, but also – by avoiding duplication and overlapping activities – means better use of community resources, too.

In identifying and mobilizing community resources, the programme works closely with community agencies and voluntary organizations. Thus participation in the program's preventive activities comes to form part of the regular work of the health professional, and is not simply an extra job or hobby. A community programme can often combine authority decisions with training and motivation of personnel. Close personal contacts between the project team and the local health personnel are important in promoting motivation and compliance.

The use of a large network of organizations and opinion leaders can encourage population participation. Many such organizations appreciate being able to contribute to the success of an important health project. Numerous personal contacts need to be made, local problems discussed, and the possibility of practical contributions assessed. The public interest and support generated by the activities via the media can encourage further intervention activities.

Because generating widespread motivation and support in the general populace forms a cornerstone of successful intervention, much of the practical work of the project tends to be shouldered by lay people and voluntary organizations. In settings such as North Karelia, trained and motivated public health nurses can be vital to an intervention programme. The role of medical doctors can also be very important, though in many programmes they act primarily as medical experts within the general framework.

3. Evaluation

Evaluation can be divided into internal and formative vs external and summative evaluation. Internal evaluation is carried out during and within the programme to provide rapid feed-back to the programme workers

and management. An overlapping concept is formative evaluation, which provides data during the programme about the experience with the various programme components and thus helps to develop ("formulate") the programme further. The summative evaluation of the programme assesses over a given time the overall effects and other findings; this is usually done by an expert group in some way external to the daily community work.

The evaluation can be categorized, as it was in the North Karelia Project, in terms of programme assessment, as follows:

1. feasibility/performance
2. effects (behaviours/risk factors, disease rates/mortality rates)
3. process
4. costs
5. other consequences.

The evaluation principles and procedures applied in the North Karelia Project are discussed in the following chapter.

6. PRACTICAL INTERVENTION ACTIVITIES

The practical intervention activities were integrated into the existing service structure and social organization of the area, as described earlier. The role of the project organization was to define the objectives, to train, to coordinate and to promote programme activities, as well as to assess the results, while most of the actual work was done by the community itself. Community involvement and individual participation was the key.

In the intervention, practical skills were taught, social support for change provided and environmental modifications arranged as part of the comprehensive community organization aimed at healthy change. Previously described theoretical frameworks were applied in planning and evaluation.

In the original project plan, intervention activities were categorized as follows, and are also described in detail in the WHO monograph (Puska et al. 1981):

(1) General public information
  – mass media
  – health education materials
  – campaigns
(2) Organization of services
  – primary health care
  – other health care
  – other services (schools, social services)
(3) Personnel training programmes
  – health personnel
  – other personnel
  – lay leaders
(4) Environmental changes
(5) Information (monitoring) systems

The following sub-programmes were initially defined:

(1) Anti-smoking
(2) Nutrition
(3) Hypertension
(4) Coronary heart disease and AMI
(5) Rehabilitation (secondary prevention)
(6) Screening (for risk factors)

Later on in the project, the intervention activities were often grouped under the following main categories:

(1) Media activities (general media campaigns etc.)
(2) Health service activities (especially primary health care)
(3) Community organization activities (campaigns and activities in partnership with various organizations in the community)
(4) Environmental and policy activities (often introduced via community partnership activities, e.g. with food manufacturers).

The following specific target programmes formed central features of the continuation phase of the project:

(1) Anti-smoking
(2) Cholesterol lowering nutrition

(3) Blood pressure lowering (increasingly emphasizing non-pharmacological interventions)

The later years saw greater emphasis being placed on increased leisure time physical activity, and other aspects of health promotion were also included (psychosocial, weight reduction, alcohol etc).

During the later phase, many of the project's intervention activities have taken the form of specific sub-programmes, often related to specific funds and resources. Some of these sub-projects are as follows:

- North Karelia Cholesterol Project (1988–92)
- Several anti-smoking projects, e.g. STOP SMOKING and SMOKE-FREE NORTH KARELIA (1993–)
- North Karelia Berry projects (1985–)
- Several Worksite Projects (1985–)
- North Karelia Youth Projects (1978–)

Details and experiences concerning some of these intervention activities are discussed in Chapter 21.

A general intervention trend over the 20 years of the project has been an evolution from somewhat more risk factor/primary health care-oriented intervention towards more health promotion/community mobilizing interventions which have utilized innovative and positive media messages, and often competitions, too (i.e. positive incentives).

7. A COMMUNITY PROGRAMME AS NATIONAL DEMONSTRATION PROJECT

In principle, a community-based project can vary from a relatively restricted academic study, or local effort, to a major programme with strong nationwide involvement. The North Karelia Project definitely falls into the latter category. At the very outset the national health authorities decided that the North Karelia Project would be a pilot for all Finland.

One advantage of an intervention programme in a small community is that an intensive intervention virtually certain to reach every inhabitant can be used. However, there are also major disadvantage: many

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important environmental decisions can only be made at the higher provincial or national level. This problem involves legislation as well as non-public sectors such as the food industry. Another disadvantage with a smaller community is the restricted applicability of the experiences to the national level.

In national demonstration projects like the North Karelia Project, the aim is to take a relatively large community (county, province, or other large geographically defined area) in which the comprehensive intervention can be implemented in a well-conceived way and subjected to careful evaluation. In addition to innovative educational interventions, community organization and major environmental modifications are used – measures with the potential to be implemented nationwide.

Important measures which are perhaps regarded as innovative and somewhat controversial are often difficult to introduce rapidly on the national scale, so they are first tested in the demonstration community, which thus acts as a "pilot" area for the nation as a whole. With proper evaluation, this national pilot area can provide sound information on feasibility, effects and other experiences of the measures applied. And when several measures are implemented in an integrated and comprehensive manner, the area may be used to assess the overall impact and experiences of an intervention package made up of several mutually supportive activities.

Thus the term "pilot" implies that implementation first takes place in a restricted area and then later on, if experiences are positive, nationwide. The terms "demonstration" or "model" have the connotation that the preventive activities are applied in a more planned and "better" way in that area – to demonstrate or show good implementation and to learn from the experiences. So nationwide activities and those in the demonstration area may well take place together and be supportive of each other, as is usually the case with demonstration projects in the industrialized countries.

Following the initial phase of the project (1972-77), the activities became largely nationwide in scale, although North Karelia continued to act as a demonstration or model area serving the nationwide efforts. This continued as a central principle when Finland joined the WHO/CINDI Programme. National policy-making has since incorporated the use of North Karelia as a national demonstration area.

Like the North Karelia Project, many current demonstration projects first started as a "pilot" activity, but later clearly became more of a "demonstration" for ongoing national activities (Puska 1988).

The advantage of such projects is that they allow us to demonstrate the work and have the experiences on a more limited scale before nationwide implementation. And while generating results and experiences, they are also powerful sources of inspiration, training and intellectual resources for action on the national level.

Visibility is another major practical advantage of national demonstration projects. Instead of trying to convince national decision-makers or attract the media with theoretical arguments, reference can be made to a practical example: "Look how it is done there. Prevention is possible and it works".

In summary, a national demonstration project is used

- to test different methods of disease prevention applied simultaneously and systematically in the same community
- to evaluate the feasibility, effects and other experiences of a major, comprehensive effort
- to be a source of public and professional inspiration, visibility, training and other intellectual resources.

For a national demonstration project to be useful and effective, two important rules exist. Firstly, the project must be meticulously and professionally planned, implemented and evaluated. Secondly, the project should have not only the sound support of the national health authorities, but also close operational links with them, because communication needs to flow both ways continuously.

In the case of the North Karelia Project, its location at the National Public Health Institute has served this need well. Relevant national considerations have continuously been taken into account in the demonstration project, while the policy and decision makers have been kept up-to-date and knowledgeable about the project.

As far as the nationwide application of a demonstration project goes, experience has shown that it often does not proceed as expected. In theory one would first test the intervention package, which would then be available for nationwide implementation. In real life, however,

nationwide developments are going on all the time, with the demonstration project continuously feeding in useful know-how as and when needed. Major summative evaluation results merge at certain points of time and are of particular importance.

The overall use of a national demonstration programme is as follows. With relevant medical information and resources and a public desire for change, a major national health problem can be initially tackled using a carefully designed and evaluated demonstration programme. This, in turn, gives valuable information on the potentials for prevention and health promotion in the society concerned. The practical findings and visible experiences can then guide the applied activities as they spread across the country through the general diffusion of ideas and national policy decisions.

REFERENCES

Ajzen I, Fishbein M. Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ, Prentice Hall, 1980.

Bandura A. Social learning theory. Englewood Cliffs, NJ, Prentice Hall, 1977.

Bracht N (ed). Community organization strategies for health promotion. New York, Sage, 1990.

Farquhar JW, Maccoby N, Wood PD, Alexander JK, Breitrose H, Brown BW Jr, Haskell WL, McAlister AL, Meyer AJ, Nash JD. Community education for cardiovascular health. Lancet 1977;1:1192–1195.

Fishbein M, Ajzen J. Belief, attitude, intention, and behaviour: An introduction to theory and research. Reading, Mass., Addison-Wesley, 1975.

Flay BR, Ditecco D, Schlegel RP. Mass media in health promotion. Health Educ Q 1980;7:127–143.

Haglund B. Community diagnosis. A theoretical model for prevention in primary health care. Scand J Primary Health Care 1983;1:12–19.

Katz E, Lazarsfeld P. Personal influence: The part played by people in the flow of mass communications. New York, Free Press, 1955.

Kottke TE, Puska P, Salonen JT, Tuomilehto J, Nissinen A. What if we forget about mass control of coronary risk factors? Projected effects of high risk versus population based prevention strategies in coronary heart disease. Am J Public Health 1985;121:697–704.

Lewin K. Field theory in social science. In Cartwright D (ed): Selected theoretical papers. New York, Harper & Row, 1951.

McAlister A, Puska P, Salonen JT, Tuomilehto J, Koskela K. Theory and action for health promotion: Illustrations from the North Karelia Project. Am J Public Health 1982;72:43–50.

McGuire WJ. The nature of attitudes and attitude change. In Lindsay G, Aronson E (eds). Handbook of social psychology. Vol. III. Reading, Mass., Addison-Wesley, 1969.

Milio N. Promoting health through public policy. Philadelphia, F.A. Davis, 1981.

Puska P (ed). Comprehensive cardiovascular community control programmes in Europe. WHO EURO Reports and Studies 106, WHO, 1988.

Puska P, McAlister A, Niemensivu H, Piha T, Wiio J, Koskela K. A television format for national health promotion: Finland's "Keys to health". Publ Hlth Reps 1987;102:263–269.

Puska P, McAlister A, Pekkola J, Koskela K. Television in health promotion: Evaluation of a national program in Finland. Int J Health Educ 1981; 24:238–250.

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J, Björkqvist S, Koskela K, Neittaanmäki L, Takalo L, Kottke TE, Mäki J, Sipilä P, Varvikko P. The North Karelia Project: Evaluation of a comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland 1972–1977. Copenhagen, WHO/EURO, 1981.

Puska P, Wiio J, McAlister A, Koskela K, Smolander A, Pekkola J, Maccoby N. Planned use of mass media in national health promotion: The "Keys to health" TV program in 1982 in Finland. C J Public Health 1985;76:336–342.

Rogers E. Diffusion of Innovations. New York, Free Press, 1983.

4. EVALUATION

Pekka Puska

1. EVALUATION PRINCIPLES

In order to maximize the impact of the North Karelia intervention and what could be learned from it, a commitment to thorough scientific evaluation was made during the planning phase of the project. Public health needs on the national level, especially the potentials for widespread CVD prevention, were the priority considerations underlying this commitment.

Evaluation in the applied framework was divided into formative/internal and summative/external evaluation. The former means that during and in connection with various intervention activities, various forms of evaluation were built in. Some of these were more formal "hard science" studies, while "softer" forms of evaluation were also commonly used to extract as much as possible from the experiences.

Summative evaluation means that over a given period of time, major evaluation work via large field studies conducted by certain external agencies (University of Kuopio, National Public Health Institute) has accumulated and summed up the overall results and experiences. Because the original project was designed for five years, the first summative evaluation covered the period 1972–1977 (Puska et al.1981). Thereafter the major population surveys were carried out at 5-year intervals, which thus came to define the interval for the main summative evaluations.

The evaluation aims of the project fall within the following programme assessment categories:

1. feasibility/performance
2. effects (behaviours and risk factors, disease rates)
3. process
4. costs
5. other consequences

The following discusses the main principles applied in these various aspects of evaluation:

(1) Feasibility/performance

Programme feasibility or performance evaluation assesses the extent to which it has been possible to implement the planned activities, i.e. what actually happened in the community. It takes account of the amount of resources that the project had available, how they were used in the community, and how well the activities reached the target populations.

Feasibility evaluation is especially important in a large and comprehensive programme where the community itself carries out the activities over a large geographical area. Before the issue of effects can be meaningfully addressed, the actual intervention must be defined. The feasibility assessment can be based on records of activities, on statistical data within the community, or on survey and other data (project statistics) collected during and after specific programme periods.

(2) Effect

The effect evaluation assesses the extent to which the main and intermediate objectives of the programme were achieved. Thus, indicators of the different objectives first need to be defined, and then measured in the community at the outset and after the given programme period(s). The effect assessment should satisfy two questions in particular: 1. Did the programme modify target behaviours and risk factors (and other possible indicators of intermediate objectives)? And if so: 2. Were these modifications associated with changes in NCD rates (mortality/incidence)?

Since the target of the programme is usually the whole community, information is collected to represent the whole population. For prevalence data (behaviours, risk factors), a representative population sample is surveyed at the outset and at the main summative evaluation points. Independent cross-sectional population samples are used so that the baseline measurements or selective loss at follow-up do not influence the findings of the subsequent follow-ups.

Relatively large sample sizes are used to detect changes in risk factor means that would be small for individuals but meaningful for the

health of the population as a whole. Large sample sizes also enable interesting sub-group analyses.

Comparison of results from baseline and follow-up surveys reveals the changes that have taken place in the target community during the programme period. However, changes over several years could well be partly or even entirely due to causes other than the intervention programme. For this reason a reference area is often used, which should be as similar to the programme area as possible ("matched"), but without the input of the programme. This study design can be called "quasi-experimental", since the study is able to control the experimental intervention and choice of reference area, but not the allocation of units to these areas (Campbell et al. 1963).

The baseline and follow-up surveys should be carried out in the programme and reference areas simultaneously and with strict adherence to identical methodology and sampling procedures. There are several problems with the use of a reference area. One is that a major national demonstration programme is likely to have an impact in the reference area, too. To eliminate the possibility of unexpected events in the reference area (that would harm the comparison), the whole country (i.e. the remainder of it) is often used as a reference area.

In major community programmes, mortality rates are collated by disease category and analyzed for the area involved. Regression-based trends are usually calculated to eliminate the random annual variation. Additional information for assessing disease changes can be extracted from hospital discharge data or special disease registers.

(3) Process

Process evaluation of a programme concerns itself with changes in the intervening variables and with change trends over time and in sub-groups of the population. The central task is to gain a realistic perspective of what has been happening between the input (i.e. the work of the project) and the output (changes in behaviours and risk factors), which is naturally related to the behavioural/social framework adopted and the definitions of the intended intervening (independent) variables. Measurement of these factors builds up a picture of how the change process in the community has led (or not) to the intended behavioural and risk factor changes.

Process variables include factors such as exposure to the various intervention measures, changes in health knowledge, attitudes and intentions, social support and environmental aspects etc. Process evaluation is also interested to learn how changes take place over time in different variables and population sub-groups. At its best, process evaluation is really interdisciplinary work, which often leans heavily on the behavioural/social sciences.

(4) Cost

Cost evaluation examines the total project resources and how they were allocated. It can also be used to assess the costs to the community, e.g. the total community costs or, more specifically, the extra costs borne by the community. Moreover, in addition to the direct community costs (i.e. mainly health service related costs), estimations can be made of the indirect community costs and savings related to the programme.

(5) Other consequences

In a major national pilot or demonstration programme, attempts should be also made to assess consequences of the programme other than those intended. If the programme involves the community deeply and leads to major lifestyle changes, it is quite possible for the process to result in other changes, too. For example, other health effects can occur. There may be positive or negative developments in people's symptoms and subjective health. (Positive changes in health-related lifestyles are usually associated with improved general health of the population). Socioeconomic, social and emotional consequences, either positive or negative, may also emerge. Data from the population surveys can often be exploited to examine such phenomena.

2. EVALUATION TOOLS IN THE PROJECT

General

Comprehensive and detailed information has been available on disease/health status in the province of North Karelia and on its determinants

and relevant trends. The sources of this information for evaluating the North Karelia Project can be summarized as follows:

Mortality: official mortality statistics
Incidence of major chronic diseases:
- Acute myocardial infarction register and stroke register (WHO MONICA criteria, National Public Health Institute)
- Cancer register (National Cancer Register, Finnish Cancer Society)

Morbidity:
- Disability data (National Pensions Institution)
- Hospital discharge information and health care utilization information (National Data Sources)
- Population survey data (National Public Health Institute) concerning diagnosed diseases, symptoms

Risk factors: population surveys (National Public Health Institute)
Health-related lifestyles: annual health behaviour surveys (National Public Health Institute)
Subjective health, quality of life: population surveys (National Public Health Institute)
Intervention process: population surveys (National Public Health Institute) and other data

The use of these data sources, the methods of data collection and the materials are described later in the respective chapters, with the exception of the main population risk factor surveys. Because references to these surveys are scattered throughout the book, the main methods and materials used are described later in this chapter.

Much of the evaluation concerns the extent of achievement of the desired effects, and is thus related to the planned objectives. The main objectives in North Karelia were a reduction of CVDs and other major NCDs, and improved health of the population. Chronic disease (cardiovascular and cancer) rates are determined by mortality data (North Karelia and the rest of Finland) and from specific disease registers (Myocardial Infarction Register in North Karelia and National Cancer Register). The general health and well-being of the population is monitored by the five-year cross-sectional population surveys and by the annual health behaviour postal surveys (North Karelia and all Finland). These

surveys are also used to measure other indicators of general morbidity (e.g. symptoms).

The intermediate objectives concern changes in risk factors and lifestyles. These are monitored by the five-year cross-sectional population surveys (in North Karelia and other monitoring areas) and by the annual health behaviour survey (North Karelia and all Finland).

Various intervention process indicators (e.g. preventive practices by health personnel, exposure to project activities, social support and interaction, behaviour change intentions, environmental influences) are also measured by the above mentioned surveys. A supplementary questionnaire is included for process evaluation in North Karelia in connection with the annual health behaviour survey. In addition, various other data sources in the community are used, as well as special ad hoc surveys and studies, to build up a more comprehensive picture of the change process in the community. For example, several published studies based on in-depth or theme interviews have been carried out to gain a more profound understanding of the nature of the change process.

In the original project phase (1972–77) the neighbouring province of Kuopio was chosen as the reference area for the programme, and this comparison was emphasized in the report of that period (Puska et al. 1981). However, there were already several indicators that the "net changes" between the two areas were likely to be conservative estimates of the true effect. Firstly, Kuopio had a new medical school established in 1972, with experts and groups active in prevention. Secondly, it was the neighbouring province, so the project was likely to have an influence there.

After 1977 the situation changed further. The North Karelia Project became actively involved in preventive work nationwide, e.g. through several major TV risk reduction programme series, other media activities, health policy activities etc. This meant that neither Kuopio province nor any other area of Finland could be a "true reference area" any longer. Risk factor monitoring has nevertheless continued in Kuopio province, with other monitoring areas gradually being included. Developments are now monitored throughout the country as far as possible, in addition to North Karelia.

Process evaluation, as well as other forms of study described later in the book, set out to assess the extent to which disease changes are related to risk factor changes, and the determinants of risk factor and lifestyle changes.

Risk factor surveys

Five cross-sectional population surveys (in 1972, 1977, 1982, 1987 and 1992) have assessed risk factor levels in North Karelia and Kuopio. In 1982, 1987 and 1992 an area of southwestern Finland was also surveyed.

For each survey, an independent random sample was drawn from the population register. In the 1972 and 1977 surveys a random sample of 6.6 % of the population born during 1913–1947 (25–59 years in 1972) was drawn in both areas. In 1982, 1987 and 1992 the sample involved people aged 25–64 years. The samples were stratified according to the WHO MONICA protocol so that at least 250 subjects of each sex and ten-year age group were chosen in North Karelia, Kuopio and southwestern Finland. The common age range in all five surveys was 30–59 years.

The survey methods were carefully standardized and comply with most international recommendations. They also followed the WHO MONICA protocol in 1982, 1987 and 1992, when they were comparable with the methods used in 1972 and 1977. The actual methods are described in greater detail in a 1981 monograph (Puska et al. 1981), while the MONICA methods appear in the respective publications (e.g. WHO MONICA Project 1988).

The surveys have included a self-administered questionnaire (mainly items on socioeconomic factors, medical history, health behaviour and psychosocial factors) and measurements of height, weight and blood pressure. A venous blood specimen has been taken to determine serum total cholesterol and HDL-cholesterol. In 1982 and 1987 serum thiocyanate concentrations, and in 1992 serum cotinine, were also determined.

The questionnaire and invitation to the examinations were always sent about 10 days beforehand. The examinations usually took place at the local health centre, where specially trained nurses took the measurements and checked the questionnaire. Every survey has adhered to the same methods as closely as possible, and each area has been treated identically (e.g. blood samples from the different areas have been analyzed in mixed order).

Casual blood pressure is measured from the right arm after five minutes sitting. The fifth phase of the Korotkoff sounds has always been recorded as the diastolic pressure. In 1972 and 1977, a shorter cuff bladder (23 cm) was used than in 1982, 1987 and 1992 (42 cm). Serum cho-

lesterol was determined in 1972 and 1977 from frozen samples using the heparinmangan precipitation method (Liebermann-Burchard), and in 1982 and 1987 from fresh serum samples using an enzymatic method (CHOD-PAP, Boehringer Mannheim, Monotest). All cholesterol determinations have been made in a central laboratory standardized against national and international reference laboratories.

Smoking has been assessed by responses to a standard set of questions in a self-administered questionnaire. The participants were thereby classified into three categories:

Current smokers – those who had been smoking regularly (cigarettes, cigars or pipe; at least once a day, on average) for at least one year and had smoked during the preceding month.

Ex-smokers – those who had smoked regularly but had stopped a month or more before the survey.

Never smokers – those who had never smoked regularly.

The measurement methods were pre-tested. The nurses were thoroughly trained before the surveys, during which their performance was monitored. A variety of validation studies has been carried out, and information has also been collected on non-participants.

The results apply to subjects aged 30–59 years, the age group common to all the surveys. Sample sizes and participation rates in the four surveys are presented in Table 4.1. Participation rates were very high, over 90 %, at the first survey in 1972. They have decreased slightly over time, but are still quite satisfactory.

	NORTH KARELIA				KUOPIO PROVINCE				SOUTHWESTERN FINLAND			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
YEAR	N	%	N	%	N	%	N	%	N	%	N	%
1972	1959	94	2056	96	2918	91	2949	94				
1977	2063	87	2020	91	2933	89	2996	92				
1982	1599	77	1511	84	1459	83	1143	88	1506	82	1487	87
1987	1521	79	1485	87	762	82	744	87	756	77	761	83
1992	759	69	750	82	768	76	735	85	747	75	720	85

Table 4.1. Samples (N) and participation rates (%) by gender, year, and area in those aged 30-59 years.

5. THE INTERVENTION IN PRACTICE

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1. INTRODUCTION

The North Karelia Project was planned as a comprehensive intervention founded on knowledge of the risk factors and understanding of relevant behavioural and social theories. The target risk factors were selected on the basis of available epidemiological knowledge about their role, and on information about their occurrence in the local population.

Practical intervention activities have been integrated into the province's existing service structure and social organization. While the project has defined the objectives, trained the personnel, coordinated and promoted the activities, and assessed the results, most of the actual work on the ground has been done by the community itself. Community involvement and individual participation were the key concepts in implementation.

Practical activities have been planned jointly by the project research team and the field office team. The prime intervention approaches have been persuasion, teaching practical skills, and social and environmental support for change. The work of the field office has largely been devoted to media activities (materials, mass media, campaigns), promoting preventive services (primary health care etc.), training professionals and other workers, facilitating environmental changes (smokefree areas, supermarket campaigns, advising food manufacturers and caterers etc.), monitoring and feed-back.

This chapter describes the practical aspects of the intervention by the project field office team in North Karelia. The office also helps perform the evaluation surveys and certain special trials and studies. The description is closest to the situation in the late 80s and early 90s, although the role and basic features of the field office have been consistent throughout most of the project.

2. ORGANIZATION AND RESOURCES OF THE PROJECT FIELD OFFICE

The field office of the North Karelia Project has always been linked to the Department of Social and Health Affairs of the North Karelian provincial administration, and in the early years was actually located there. Since the early 80s the field office team has had a separate home, most recently in an apartment overlooking Joensuu's central market place and owned by the North Karelia Project Research Foundation.

The work of the project office is supervised by the project director and the intervention working group, which consists of the key researchers and the field office staff. They meet monthly for discussions and to decide on aspects of the implementation. Day-to-day work at the project office is led by the executive manager of the North Karelia Project.

The office team has varied in size according to the need and extent of activities and current financial resources. However, the basic team has always had an Executive Manager, office secretaries, health work organizers (mainly public health nurses) and behavioural/social experts.

The performance of the project office team is evaluated from time to time. All staff members have periodically kept records of their own work, although there tends to be some difficulty in classifying and assessing this. Memos of meetings and other documents of the intervention working group have also been used for these evaluations.

The workload varies according to its nature and location, and the office staff have proved flexible in adapting their working hours to current intervention needs. Every office member has put in overtime at some phase of the project, and there have never been major problems in arranging activities to suit the needs of the community and the resources of the office staff.

1990 and 1991 were special years for process evaluation. In 1990 the North Karelia Project employed nine full-time and eight part-time field office staff, who worked a total of over 18 000 hours that year. In 1992 the six full-timers and five part-timers employed accumulated about 12 000 working hours.

Project office work can be divided into four main areas: 40–50 % is classified as "community organization work" (i.e. related to planning and coordination of community activities), 6–9 % as "administrative work",

20–25 % as "health education planning", and 25–30 % as "health education in action" (counselling, health education meetings, risk factor measurements in the field etc.). Most staff members are ready to engage in any kind of work demanded by the actual situation.

Project office work includes a variety of activities which support the objectives and general goals. The principles are planned in collaboration with the researchers, mostly within the intervention working group mentioned earlier. In 1990 this group was convened 15 times and in 1991 ten times.

Certain activities are initiated as special sub-projects of the overall intervention. In 1990 there were six separate subprojects: the Cholesterol Project, the Smokefree Campaign, "My Choice"/School Health Programme, the Work Site Health Programme, the Health Fair, and the Berry and Vegetable Project.

Over the years the activity devoted to separate projects and campaigns has fluctuated greatly. Numerous specific needs have arisen from time to time, against an uneven background of financial resources and demands. Not surprisingly, some specific issues have received more attention than others, although the office team has always upheld as a priority the need to sustain the interest of the local population in the project.

3. STAFF DUTIES

Collaboration with many kinds of community organization, and at many levels, requires different kinds of personnel. The project co-ordinators must be able to negotiate with experts and community workers of all types. The initial step is always to seek out common benefits arising from the collaboration. Comprehensive engagement with community organizations ultimately impresses the project on the lives of ordinary people. It has been essential for the project staff to work in the community – alongside local people and involved in everyday life. The project work has been highly visible in the form of cholesterol and blood pressure measuring, nutrition counselling and other practical guidance, and in media campaigns advising people how to change their lifestyles.

The executive manager of such a project is mainly responsible for personnel administration, financial issues, general office work, and for

certain community organization activities. In the North Karelia Project he has also acted as secretary of the intervention working group. The main skills needed for the job are a keen ability to negotiate and organize, and a good medical and managerial background for coping with a diversity of experts and community representatives.

The project workers who plan the programmes and campaigns, and who collaborate with the experts, have to understand the basic principles of behaviour, mass-communication, the medical background of chronic diseases, and business and social relationships. They also need to be familiar with theories like innovation-diffusion and synergy.

Staff members working directly with local people (clients/patients) must have sound knowledge of the medical and epidemiological background of the chronic diseases, and of human behaviour, as well as technical skills for clinical measurements, e.g. for serum cholesterol and blood pressure. Public health nurses have occupied this role in the North Karelia Project, and the variety of tasks in the surveys has given them a wide working experience.

Nothing goes well if there are problems with office and secretarial services. Fortunately, the project has been blessed with skilled secretaries who have managed book-keeping, general correspondence, mailing of materials and general office duties.

4. MAIN ACTIVITY AREAS

The main areas for practical intervention are media activities, preventive services, training of professionals and other workers, environmental changes, monitoring and feed-back.

MEDIA ACTIVITIES

The production of health education material has been a priority throughout the North Karelia Project. Leaflets, books, posters etc. have been planned by the project director and other researchers together with project workers and community representatives. Sometimes this work has been assisted by advertising companies and various collaborators. The printed materials are important aids for developing social contacts

and various practical activities. They have also been sold to other areas of Finland, thereby supplementing project finances.

The Cholesterol Project published a magazine of its own, "Suoraan Sydämeen" (Straight to the Heart), five times during the years 1989-1992. The magazine was financed through advertising. Most of the videotapes were made by the Youth Project, for smoking prevention and nutrition counselling.

The radio and TV-campaigns produced by the project have been directed against smoking and at enhancing knowledge about healthy lifestyles. The TV-campaigns were planned by the project director in collaboration with the programme editors. Although these programmes were broadcast nationwide, the studio audiences were from North Karelia.

The local press, and some national publications too, have been kept well-informed of activities and findings. Press conferences have been arranged and hundred of news stories and articles published during the project period. Topical items have usually been released at press briefings, because journalists prefer to write their own stories. This guarantees as far as possible that the issues are actually read by the public, because the articles have personal styles and tend to be somewhat livelier than the original press releases.

Preventive services

Preventive health services are linked to the daily work of health centres and hospitals. This has been a particularly active arena for the North Karelia Project. Doctors, nurses and other health professionals all need to understand the importance of systematic measurements, counselling, persuasion, and follow-up of people's health related habits. A variety of treatment guidelines and model programmes have formed the backbone of training in these areas.

In association with staff of the local health services, various preventive activities and guidelines have been developed. These have been implemented by local authority decisions and through the training and motivation of personnel. The community is routinely informed of such developments.

Most of the training of professionals and other workers by the North Karelia Project has been via seminars on current topics. Numerous sem-

inars have been arranged for medical doctors, nurses, home economics teachers, canteen-supervisors, nutritional workers etc. over the years. Practical activities have often been included, e.g. cholesterol measuring, exhibitions, food tasting. Researchers at the National Public Health Institute have often been invited to present the latest results of the population surveys or smaller studies.

The staff of the North Karelia Project have often given lectures and had meetings with school children, voluntary organizations, visitors to the project etc. Collaboration between the project and other institutions responsible for training professionals has been very active, with the project participating in their training and educational work (e.g. nursing schools).

Environmental changes

The North Karelia Project encourages work sites, schools, homes etc. to create smoke-free areas. The earlier sign – "no smoking" – was modified to a positive term – "smoke-free". Nowadays, work sites, classes, airports, sports clubs, and indeed most indoor public facilities throughout the land are smoke-free. Supportive cards, stickers and posters have been supplied by the project.

Supermarkets wanting to organize special health campaigns or 'health days' offering cholesterol and blood pressure measurements have provided the opportunity to counsel people right where they buy their daily food, and also to liase with the supermarkets.

Collaboration with food manufacturers and caterers is routine daily work for the North Karelia Project. In addition to presenting seminars, this has involved issues such as legislation, labelling, mass communication and advertising using health arguments, food processing, new product development, pricing policy, information exchange, campaigns and financing of the project's programmes. The underlying purpose of this work has been to help people buy healthy products at competitive prices, while the main specific objectives have been to decrease saturated fat intake and boost the consumption of vegetables, vegetable oil and berries.

Monitoring and special studies

The National Public Health Institute is responsible for the general follow-up and monitoring, which is based on mortality data, diseases registers, population risk factor surveys, and health behaviour surveys etc. The project field office is also actively involved with many aspects relating to the process and formative evaluations. The health behaviour surveys have questions about the person's exposure to various intervention activities, which provides immediate feed-back.

The health education materials and media campaigns rely heavily on the results of the monitoring. People are told plenty about favourable lifestyle and risk factor trends and the associated reductions in mortality and disease rates.

To promote general interest and expand overall resources, the project has initiated several trials and special studies in support of other activities. Among other things, these trials have tested a variety of drugs for high blood pressure or cholesterol, as well as nicotine patches, nicotine chewing-gums, special diets etc.

Special intervention aspects

Competitions as a framework for organizing campaigns have been a great success in the health education work. The project has arranged numerous competitions in collaboration with the food-industry, the media, schools, sports clubs, voluntary organizations etc. over the past twenty years.

The North Karelia Project staff have been actively involved members of many voluntary organizations. This has been a good way of deepening collaboration and keeping it flexible.

People's life-styles have both cultural and practical dimensions. It may be difficult for a person to make major changes in his/her life-style if the corresponding changes are not apparent in the community or society at large. Timely and appropriate decisions and actions are needed from the government so that healthy choices are available and the public sufficiently informed. The project has been a major and diverse contributor to many policy decisions on the national and local levels. The fact that the project director represented North Karelia in the National Parliament from 1987–1991 was important in this respect.

The cooperation of the local health services and health personnel has guaranteeed a firm foundation for the project activities. Numerous community organizations have also contributed greatly over the years. Because project activities have been integrated into the existing health services and broad community participation has been a key feature, the overall costs of the programme have been kept modest.

5. ADMINISTRATION AND FINANCING OF THE FIELD OFFICE WORK

As mentioned earlier, the project office has been loosely connected with the provincial administration, which has provided some basic resources. The present field office facilities are owned by the North Karelia Project Research Foundation. This Foundation and a special North Karelia Project Support Association are non-governmental organizations controlled by the project team in practice. These bodies help with administration and finance.

In the national context, the National Public Health Institute (current site of the project director and many of the researchers) has coordinated and overseen the overall task.

The money to employ staff and finance the work has come from various sources, often on an annual basis. The most important current contributors are as follows:

- The Finnish Slot Machine Association: Funds allocated by the Government, especially for basic field office costs (executive manager etc.)
- Ministry of Health: Funds from tobacco taxes, especially to finance certain anti-smoking and health education programmes
- The National Public Health Institute: particularly costs related to field surveys, international aspects and project coordination
- Food manufacturers, pharmaceutical industry etc: Funds to support special field trials and campaigns.

In addition to these core funds, many of the actual programme intervention costs are absorbed by the collaborating organizations. As

stressed earlier, the direct project funds are used mainly for "catalyzing" the intervention activities in North Karelia.

INTERVENTION: PERFORMER AIM	PROJECT DIRECTLY	COMMUNITY ORGANIZATION				
		A	B	C	D	E
INFORMATION	++	++	++	++	++	-
PERSUASION	++	++	++	++	++	+
PRACTICAL SKILLS	++	++	++	++	++	-
SOCIAL AND ENVIRONMENTAL SUPPORT	++	+	+	++	++	++
COMMUNITY ORGANIZATION						
A) MASS MEDIA	++	*	+	++	++	+
B) HEALTH & OTHER SERVICES	++	+	*	+	-	++
C) OTHER ORGANIZATION	++	++	+	*	+	+
D) INDUSTRY, BUSINESS	++	++	+	++	*	++
E) LEGISLATION	+	++	+	+	+	*

++ Strong potential influence
+ Weak potential influence
- No influence
* Not applicable

Table 5.1. Intervention aims according to different performers in community intervention programme: model used in the North Karelia project.

II

Risk Factors and Health Behaviour

6. TWENTY YEAR TRENDS IN CORONARY RISK FACTORS IN NORTH KARELIA AND OTHER AREAS OF FINLAND

Erkki Vartiainen, Pekka Puska, Pekka Jousilahti, Heikki J. Korhonen, Jaakko Tuomilehto and Aulikki Nissinen

1. INTRODUCTION

The unequivocal role of serum cholesterol, blood pressure and smoking as risk factors for cardiovascular diseases (CVD) was established in the 1960s and 1970s by laboratory and epidemiological studies and clinical trials. Twenty years ago Finland suffered the highest coronary mortality in the world (Keys 1970), with its eastern province of North Karelia being the worst afflicted.

Knowledge of the main risk factors and the urgency of this predicament led, in 1972, to the launch of the North Karelia Project – a comprehensive community-based programme designed to prevent CVD through general lifestyle and risk factor changes, and including detailed scientific evaluation (Puska et al. 1985). Similar community-based prevention programmes were initiated later in the 1970s and 80s in other countries. The central aim has been to determine the extent to which risk factors can be modified in whole populations, and whether such change leads to reduced coronary heart disease mortality in those populations (Abramson et al. 1981, Feruglio et al. 1983, Fortman et al. 1981, Gutzwiller et al. 1985, Heineman et al. 1986, Nüssel et al. 1988). Most of the programmes so far evaluated have shown that risk factors can indeed be reduced, and during the 1980s many countries began evolving nationwide strategies to reduce coronary heart disease mortality.

The original aim of the North Karelia Project was to test the feasibility and effects of a community based programme for preventing cardiovascular diseases within that province. However, it was not long before measures dedicated to the same goal were being initiated throughout the country, and since 1977 the North Karelia Project has been ac-

tively involved in these, too. Examples include the national anti-smoking legislation which was enacted in the late 1970s (Leppo et al. 1986), and the treatment of blood pressure that became widespread around that time. Nutrition policies for disease prevention and health improvement were evolved during the 1980s (Nutrition Policy in Finland 1992).

Since 1978 the North Karelia Project has co-produced several major TV series devoted to risk factor reduction.

For the past 10 years North Karelia has served as a national demonstration area for innovations in chronic disease prevention and health promotion. While most of the sub-programmes in the main project have been evaluated in normal ways, the overall development in risk factors has been monitored by risk factor surveys, on which several reports are available (Puska et al. 1983, Vartiainen et al. 1991).

This chapter describes the changes in cardiovascular risk factors over 20 years (1972 to 1992) in North Karelia, as well as in other areas of Finland monitored by similar population surveys. There is emphasis on the assessment of the persistence of changes in North Karelia, as well as on nationwide developments. In addition to the target risk factors, changes in body mass index and physical activity are also presented.

2. MATERIAL AND METHODS

Five cross-sectional population surveys (every five years: 1972, 1977, 1982, 1987, and 1992) were used to assess CHD risk factor levels in the eastern provinces of North Karelia and Kuopio. The third area in southwestern Finland that was included from 1982 onwards incorporates the city of Turku, a small town (Loimaa) and 12 nearby rural municipalities. North Karelia has about 180 000 citizens, Kuopio province 250 000 and the southwestern survey area about 210 000. Independent random samples were drawn from the population register for each survey.

The materials and methods of these surveys are described in an earlier chapter, as are the sample sizes and participation rates in the five surveys. The present analysis concerns subjects aged 30–59 years (Table 6.1).

Analysis of variance was applied to the means of the North Karelia and Kuopio populations for 1972, 1977, 1982, 1987 and 1992, and from 1982 to 1992 to all three areas. For proportions, a log-linear model was

	NORTH KARELIA				KUOPIO PROVINCE				SOUTHWESTERN FINLAND			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
YEAR	N	%	N	%	N	%	N	%	N	%	N	%
1972	1959	94	2056	96	2918	91	2949	94				
1977	2063	87	2020	91	2933	89	2996	92				
1982	1599	77	1511	84	1459	83	1443	88	1506	82	1487	87
1987	1521	79	1485	87	762	82	744	87	756	77	761	83
1992	759	69	750	82	768	76	735	85	747	75	720	85

Table 6.1. Samples (N) and participation rates (%) by gender, year, and area in those aged 30–59 years.

employed as the statistical method. Scheffe's test was used for multiple comparisons between different areas for each year (SPSS Base System User's Guide 1990).

3. RESULTS

3.1. Serum Total Cholesterol

Total serum cholesterol in men fell by 16 % (1.07 mmol/l) in North Karelia and 12 % (0.79 mmol/l) in Kuopio between 1972 and 1992 (Figure 6.1). During the first five years the reduction was greater in North Karelia, but thereafter more or less equal in the provinces.

In none of the areas was the small decline in total cholesterol between 1982 and 1987 statistically significant, whereas the final period from 1987 to 1992 resulted in significant reductions in all three areas. The proportion of North Karelian men with cholesterol levels of 6.5 mmol/l or higher declined from about 60 % in 1972 to 28 % in 1992 (Table 6.2).

The differences between the areas for each survey year were tested for multiple comparisons by Scheffe's test in 1982, 1987 and 1992, and by the t-test in the first two surveys. In 1972 the cholesterol level among men of North Karelia was significantly higher than in Kuopio, after which no difference was observed. In 1982 the cholesterol level in the southwestern area differed from that in North Karelia and Kuopio.

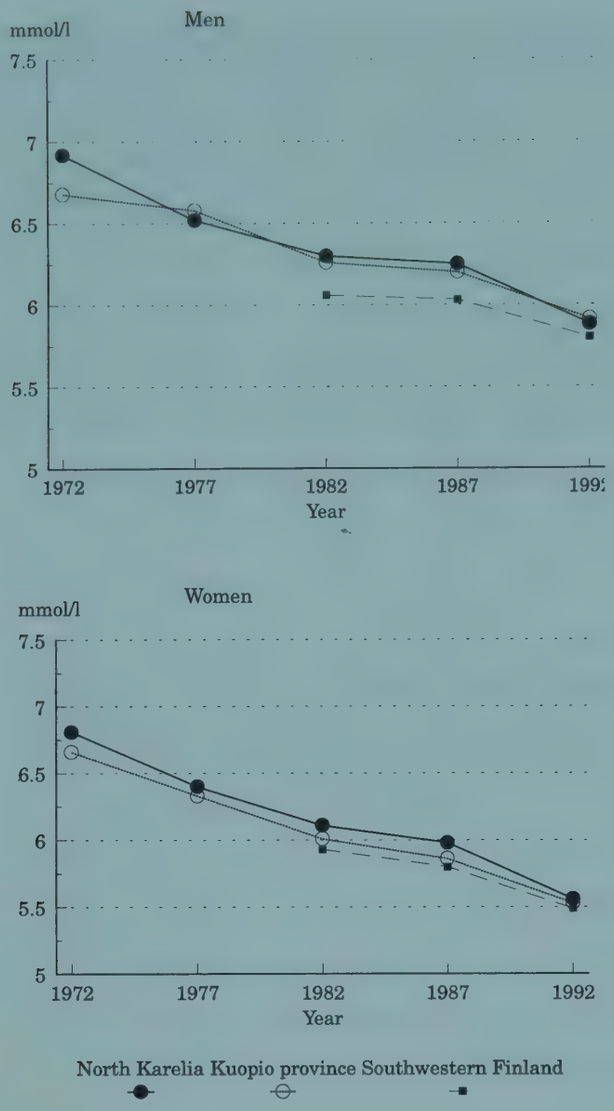

Figure 6.1. Mean cholesterol level by gender, area and year

	NORTH KARELIA					KUOPIO PROVINCE					SOUTHWESTERN FINLAND		
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992	1982	1987	1992
						MEN							
LESS THAN 5 MMOL/L (%)	6	11	12	14	21	7	8	13	16	20	16	18	23
5 - 6.49 MMOL/L (%)	34	41	47	49	52	40	42	51	47	52	52	50	55
6.5 + MMOL/L (%)	60	48	40	38	28	54	50	36	37	28	32	33	23
MEAN	6.92	6.52	6.30	6.25	5.85	6.68	6.58	6.26	6.20	5.89	6.06	6.03	5.79
SD	1.32	1.23	1.18	1.19	1.19	1.21	1.23	1.21	1.24	1.15	1.11	1.19	1.11
N	1742	1702	1229	1138	521	2513	2601	1206	599	583	1233	566	663
						WOMEN							
LESS THAN 5 MMOL/L (%)	7	13	20	22	33	9	14	21	22	32	21	27	36
5 - 6.49 MMOL/L (%)	36	44	46	48	50	39	45	48	53	50	50	47	47
6.5 + MMOL/L (%)	57	43	35	31	17	52	41	31	35	18	29	27	17
MEAN	6.81	6.40	6.11	5.98	5.56	6.66	6.33	6.01	5.86	5.53	5.93	5.80	5.49
SD	1.37	1.35	1.32	1.24	1.08	1.29	1.28	1.28	1.17	1.03	1.19	1.21	1.09
N	1880	1817	1268	1246	600	2607	2731	999	629	619	1291	612	609

Table 6.2. Serum cholesterol level by gender, area and year in those aged 30–59 years.

Over the whole period, serum total cholesterol declined among North Karelian women by 18.4 % (1.25 mmol/l), and by 17.0 % (1.13 mmol/l) in Kuopio. Levels were slightly higher in North Karelia early on, but in the last five years this difference vanished. Women's cholesterol levels fell significantly between 1982 and 1987, when the same trend among men was not significant. During the last five years the reduction was 7.0 % in North Karelia, 5.6 % in Kuopio and 5.3 % in southwestern Finland. The proportion of women with levels at or exceeding 6.5 mmol/l declined to about 17 % in all three areas.

The Scheffe test revealed that the difference between North Karelia and southwestern Finland in 1982 had disappeared by 1992.

3.2. Blood pressure

Between 1972 and 1992 systolic blood pressure among men fell by 4.8 % (7.1 mm Hg) in North Karelia and 4.1 % (6.0 mm Hg) in Kuopio (Figure 6.2). During the first five years the reduction was greater in North Karelia, while by the third survey blood pressure had actually risen slightly in both areas, before falling again during the last ten years from 1982 to 1992. In southwestern Finland systolic blood pressure declined more between 1982 and 1987 than over the last five years. On the basis of Scheffe's multiple comparison test in 1982, only the difference between southwestern Finland and Kuopio was statistically significant, while in 1987 southwestern Finland differed from both eastern provinces. In the last survey no differences between the areas were statistically significant.

Over the 20 year period diastolic blood pressure in men declined by 8.1 % (7.4 mm Hg) in North Karelia and 10.2 % (9.5 mm Hg) in Kuopio. The differences between the areas observed in earlier surveys had disappeared by 1992.

In women, systolic blood pressure decreased throughout the entire monitoring period from 1972 to 1992. In North Karelia the reduction was 11.3 % (17.3 mm Hg) and in Kuopio province 8 % (11.7 mm Hg). Southwestern Finland had a much smaller decline. Although the level was much higher in North Karelia at the start, it fell to below the Kuopio level during the first five years. Tested by Scheffe's test in 1982 all the differences between the areas were statistically significant, but then disappeared over the next ten years.

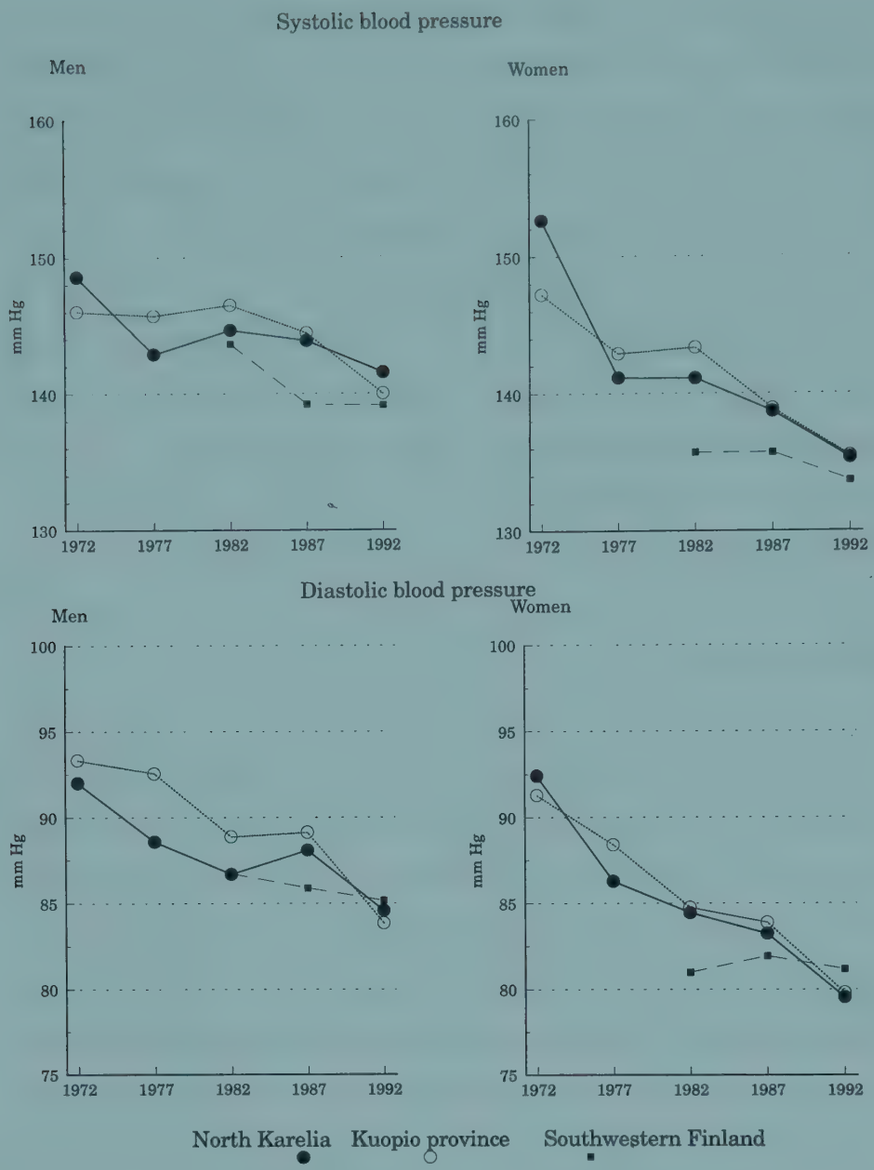

Figure 6.2. Blood pressure by gender, area and year

Diastolic blood pressure also declined during the follow-up period: by 13.9 % (13.9 mm Hg) in North Karelia and 12.9 % (11.5 mm Hg) in Kuopio. In the last survey, diastolic blood pressure was lower in eastern than southwestern Finland for the first time.

Over 20 years, the percentage of North Karelians with diastolic blood pressure exceeding 95 mm Hg fell in North Karelia from about 40 % in both sexes to 18 % in men and 11 % in women (Table 6.3).

3.3. Smoking

Smoking declined more decisively in North Karelia than Kuopio (Table 6.4). In the former, 52 % of men were smokers in 1972 and 32 % in 1992; the reduction in the latter was from 49 % to 37 %. No change was observed in southwestern Finland, and North Karelia had the lowest

	NORTH KARELIA					KUOPIO PROVINCE					SOUTHWESTERN FINLAND		
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992	1982	1987	1992
						MEN							
SYSTOLIC 160 + (%)	26	16	22	19	18	23	22	23	21	17	20	13	11
MEAN	148.6	142.9	144.7	143.9	141.5	146.0	145.7	146.5	144.4	140.1	143.6	139.2	139.2
SD	21.0	17.7	19.2	18.9	19.2	21.0	19.3	18.3	18.5	18.2	19.0	16.7	16.7
N	1744	1765	1227	1139	521	2520	2607	1207	599	582	1231	566	562
DIASTOLIC 95 + (%)	37	23	26	27	18	40	35	33	29	17	24	20	21
MEAN	92.0	88.6	86.7	88.1	84.6	93.3	92.6	88.9	89.1	83.8	86.7	85.9	85.2
SD	12.2	11.0	12.7	11.8	12.4	11.8	11.9	13.3	11.1	11.9	12.3	11.5	12.3
N	1742	1764	1227	1139	521	2520	2607	1207	599	582	1231	566	562
	WOMEN												
SYSTOLIC 160 + (%)	36	17	19	17	14	29	20	20	17	13	14	13	11
MEAN	152.6	141.2	141.1	138.7	135.3	147.2	142.9	143.3	138.9	135.5	135.7	135.7	133.5
SD	26.0	21.0	19.7	20.6	20.9	25.5	22.1	22.3	20.5	21.7	20.0	21.1	19.4
N	1887	1834	1267	1249	612	2621	2747	999	631	624	1293	614	612
DIASTOLIC 95 + (%)	40	18	19	14	10	34	25	20	16	12	11	12	11
MEAN	92.4	86.3	84.5	83.2	79.5	91.3	88.4	84.8	83.9	79.8	81.0	81.9	81.2
SD	13.6	10.9	12.0	11.5	11.3	12.1	11.9	11.9	11.3	11.9	11.7	11.1	11.0
N	1886	1834	1267	1249	611	2620	2747	999	631	624	1293	614	612

Table 6.3. High systolic and diastolic blood pressure and mean values in those aged 30–59 years.

smoking prevalence in 1992. Female smokers were rather uncommon 20 years ago, but increased steadily from about 10 % to 19 % in both eastern areas. No change took place in southwestern Finland in the last ten years.

3.4 Body mass index

Changes in body mass index (BMI, kg/m^2) are shown in Figure 6.4 and 6.5. Men gained weight from 1972 to 1987, but not during the next five years. The trend was similar in North Karelia and Kuopio provinces. In women BMI fell from 1972 to 1982 but levelled off in the next five year period and slightly increased thereafter. The proportions of obese people are shown in Table 6.5.

3.5 Physical activity

Leisure time physical activity has increased (Figure 6.6). The greatest increase was in the proportion of people reporting leisure time physical

	NORTH KARELIA					KUOPIO PROVINCE					SOUTHWESTERN FINLAND		
YEAR	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992	1982	1987	1992
						MEN							
SMOKERS	52	44	36	36	32	50	44	42	41	37	39	38	39
EX-SMOKERS	20	27	30	28	25	22	27	24	24	26	29	27	28
NEVER SMOKERS	28	29	34	37	43	29	28	34	35	37	32	34	33
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1802	1733	1185	1157	517	2566	2557	1181	606	582	1198	576	562
						WOMEN							
SMOKERS	10	10	15	16	17	11	12	15	15	19	22	23	23
EX-SMOKERS	2	5	8	12	13	3	6	8	11	14	11	13	15
NEVER SMOKERS	88	85	77	73	70	86	82	77	74	68	67	64	62
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1955	1824	1238	1274	612	2693	2729	986	636	622	1275	625	612

Table 6.4. Proportion of smokers, ex-smokers, and never smokers by gender, year and area in those aged 30-59 years.

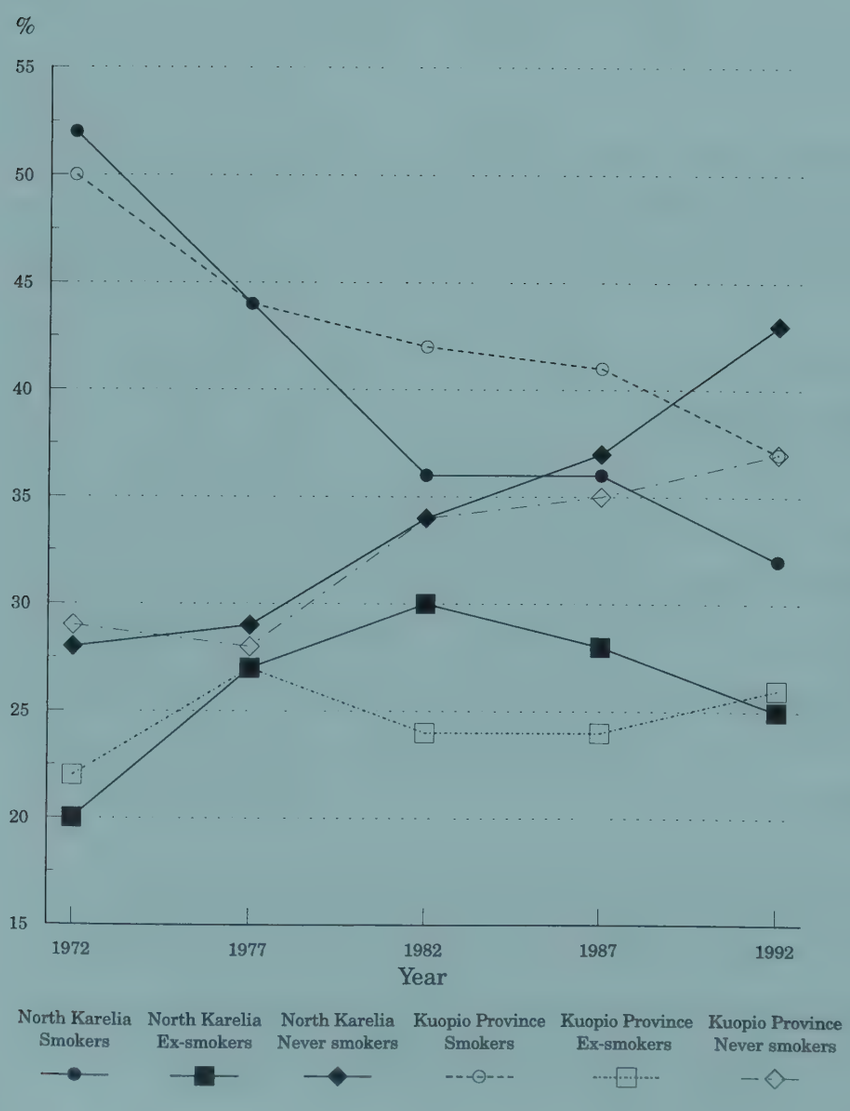

Figure 6.3. Percent of smokers, ex-smokers and non-smokers by area and year in men

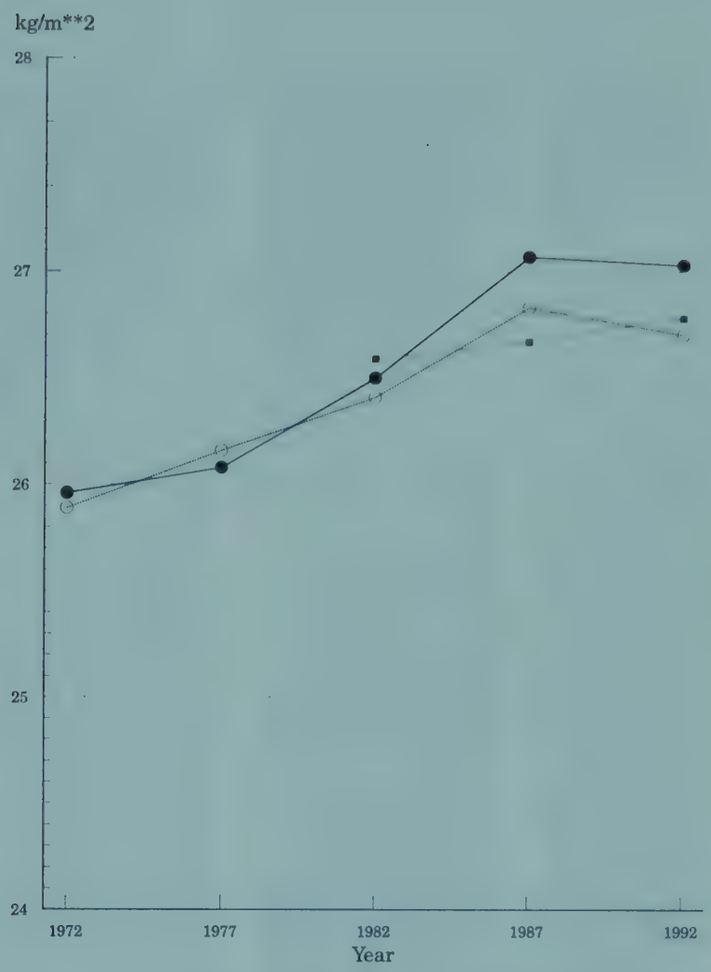

Figure 6.4. Body mass index by year and area in men

	MEN			WOMEN		
	NORTH KARELIA	KUOPIO PROVINCE	SOUTH WESTERN FINLAND	NORTH KARELIA	KUOPIO PROVINCE	SOUTH WESTERN FINLAND
	%	%	%	%	%	%
– 24.9	35	37	35	48	47	53
25 – 26.9	22	22	23	17	16	17
27 – 29.9	22	22	22	17	15	15
30 +	21	20	20	19	22	16
TOTAL	100	100	100	100	100	100
N	521	502	502	611	621	612

Table 6.5. Percent of obese people by area and gender in 1992 in those aged 30–59 years.

activity 2–3 times a week. The percentage of people not having physical activity with any sweating and breathlessness has decreased from about 30% to 20% in men and from 40% to less than 20% in women. Physical activity at work has declined; the percentage of people who walk and lift a good deal has fallen most, while sitting has increased the most. In men, heavy physical work has also declined (Figure 6.7).

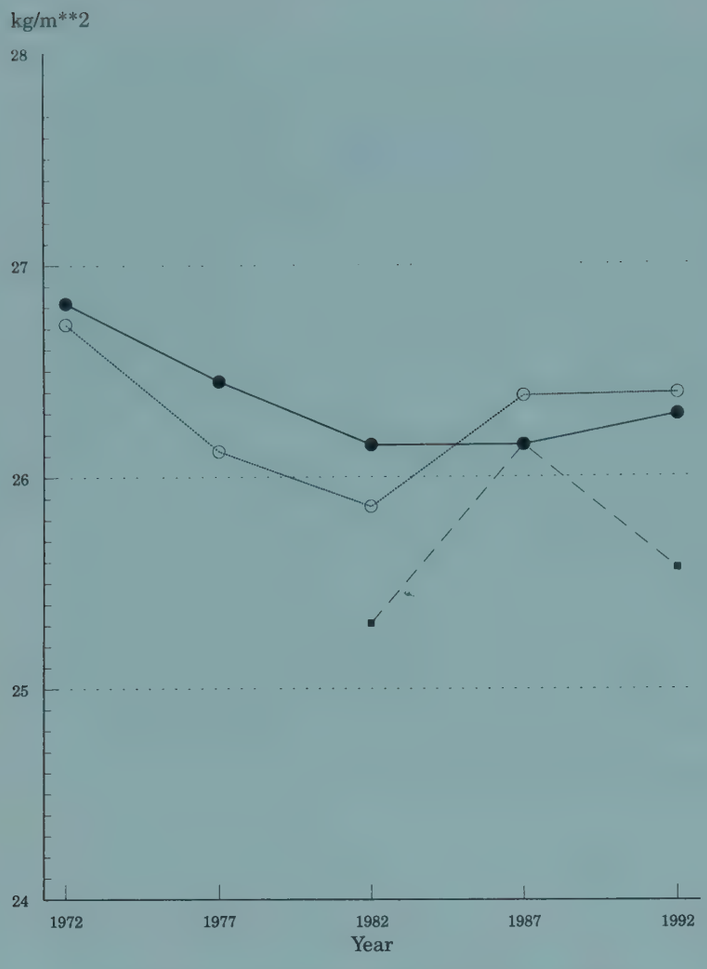

Figure 6.5. Body mass index by year and area in women

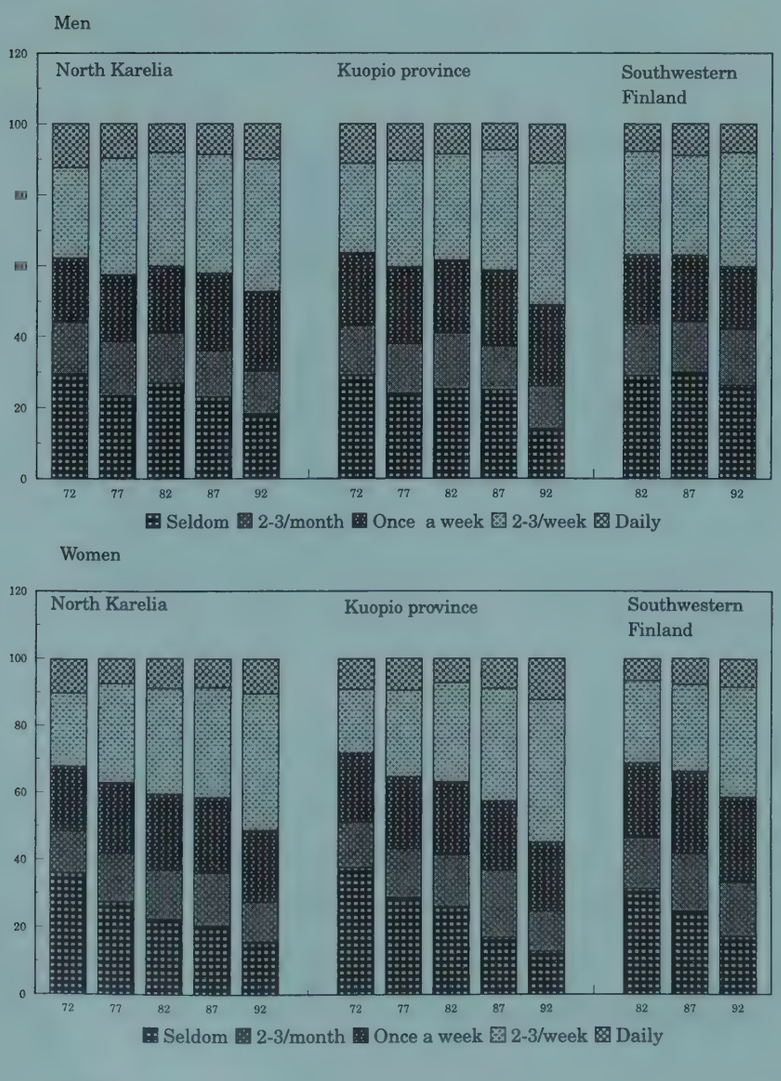

Figure 6.6. Leasure time physical activity with sweating and breathlessness

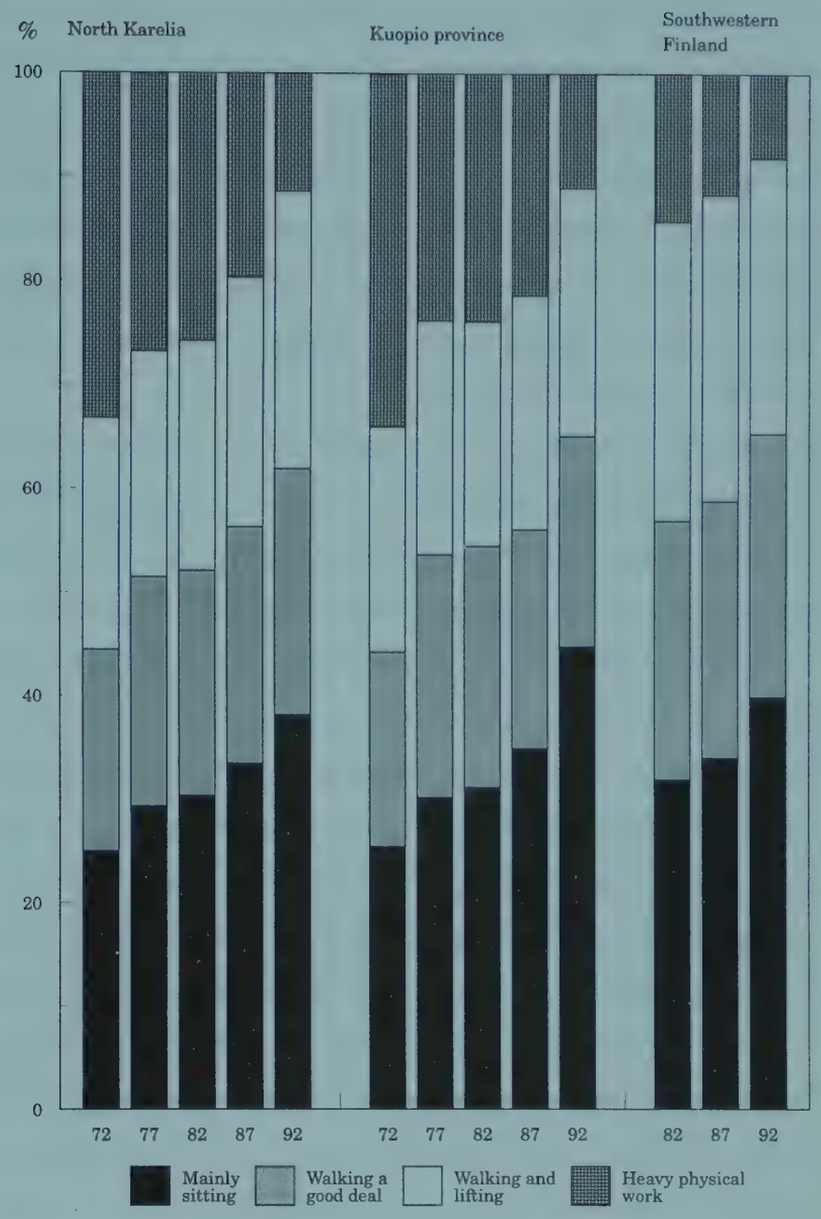

Figure 6.7. Physical activity at work by year and area among men

4. DISCUSSION

Cardiovascular risk factor reduction in the entire population was a major priority for the North Karelia Project, as it has been for the nationwide chronic disease prevention strategies. The results presented here show that during the first five years total serum cholesterol and blood pressure fell more in North Karelia than the reference area, but that subsequently these developments were about the same in the two areas, with the decline levelling off between the 1982 and 1987 surveys. This prompted the introduction of new preventive activities around the country, which again led to major declines in both serum total cholesterol and blood pressure during the last five years. Smoking declined more in North Karelia than Kuopio in the first ten years. Some further decline has been observed in both areas in the last ten years.

Cholesterol levels tended towards smaller standard deviations in the more recent surveys. This may be because the overall risk factor distributions were shifted to lower levels, while higher risk factor values fell more in absolute values. For blood pressure, the greatest change in standard deviation was between the 1972 and 1977 surveys, when large scale hypertension drug treatments were started in Finland. Early on, treatment was more active in North Karelia, where the standard deviation was first to decline.

Saturated fat consumption used to be very high in Finland. In the late 1960s the Finnish diet was highly atherogenic, with about 23% of energy intake coming from saturated fats (Koskinen 1975). Ten years ago there was still about 20% of energy intake from saturated fats, and the use of polyunsaturated fats was very low (Pietinen et al. 1988). Gradually there has been a wholesale shift from butter to margarine and from full-fat to low-fat milk (Pietinen 1990). These observed dietary changes accord well with the falls in cholesterol level. There were some signs that declines in cholesterol were levelling off in the early 1980s, especially among men. The 1980s saw further decreases in the use of traditional sources of saturated fats like butter and fatty milk, but there have been simultaneous increases in the consumption of dairy products such as cheeses and new types of milk fat, which probably accounts for the only minor changes in serum cholesterol level from 1982 to 1987 (Pietinen 1990).

However, during this period positive results from the Lipid Research Clinics cholesterol trial (Lipid Research Clinics Program 1984) were published, and the National Cholesterol Consensus Conference was held in the U.S. These enhanced the interest in cholesterol issues, and many other countries began considering new activities in nutrition policy. In 1987 the Finnish Cardiac Society and Internists' Association made their recommendations on cholesterol levels and screening for the population, on the basis of which "normal" cholesterol is less than 5 mmol/l (193 mg/dl), "elevated" from 5 to 6.5 mmol/l (251 mg/dl) and "greatly elevated" from 6.5 mmol/l upwards. It was recommended that adults over 20 years old be screened every five years.

These recommendations stimulated public interest in cholesterol and nutrition issues, and the medical community appeared to have no major problem in accepting them. However, the dairy industry launched

a major advertising campaign against the cholesterol hypothesis, attacking the North Karelia Project and questioning the proposed role of saturated fats in atherosclerosis. This controversy further raised the profile of healthy nutrition. Fortunately, most people appear to have placed greater trust in the medical and nutritional community judging by the major reduction in cholesterol levels over the last five years, which mirrored a decline in milk fat consumption and a rise in vegetable oil use (Pietinen 1990).

The laboratory methods for cholesterol determination changed between 1977 and 1982, as explained earlier. In our laboratory the enzymatic assay method gave 2.4 % lower values than Liebermann-Burchard. Cholesterol values from the 1972 and 1977 surveys have thus been corrected accordingly. All cholesterol determinations were made in the same central laboratory and standardized against national and international reference laboratories. The laboratory control data from 1978 to 1992 originated from the WHO reference laboratory in Prague; the bias was -1.29%, standard deviation 1.88, and the coefficient of variation averaged 1.23%. For the 1972 survey our laboratory was standardized against the CDC laboratory in Atlanta, Georgia. The cholesterol measurements were within the recommended limits (Puska et al. 1981).

Smoking declined more in North Karelia than Kuopio, and fastest in the 1970s. The main indicator of this decline was the growing proportion of ex-smokers. In the 1980s the proportion of ex-smokers remained more or less constant, or even declined, while the percentage of never smokers has risen. Obviously, fewer young men started smoking in the 1960s and 70s than in the previous decades.

Because the participation rate had declined over time, we conducted a special survey of non-participants by phone and mail in 1992; 50% were contactable. Among participants the smoking rate was 38% and among non-participants 53%. So part of the decline in smoking could be explained by the declining participation rate, especially in the later surveys. However, it is unlikely that the major decline in smoking in the first ten years can be explained by different participation rates. Validation of the self-reports with the serum thiocyanate and cotinine determinations has generally shown good agreement, and it is concluded that self-reporting in these cross-sectional surveys is generally valid.

Major national strategies were developed in the late 70s to reduce smoking throughout the nation (Leppo et al. 1986). Stricter tobacco legislation entered the statute books, and there was lively discussion about tobacco control. A nationwide decline in smoking was associated with these developments, and an even faster fall accompanied the special activities in North Karelia. No real progress occurred in the 1980s. In 1994 the Parliament passed new tobacco legislation and many interest groups are developing fresh activities to reduce smoking in Finland, with North Karelia in frequent use as a demonstration area.

Smoking increased among women, especially between the 1977 and 1982 surveys. The main reason for this was that teenagers who started smoking in the 1960s fall into this age group. Most of the programmes were directed at middle-aged men, and were thus unlikely to influence teenage girls. However, several programmes have been directed at young people (Vartiainen et al. 1991) and it seems now that the increase in women's smoking is diminishing in eastern Finland and has stopped in the southwest.

Only part of the decline in blood pressure can be explained by drug treatment, because the whole distribution has been shifted to the left. As the mean body mass index has increased, especially in men, and alcohol consumption has also risen, these cannot explain the phenomenon. The fall in salt consumption during the last 10 years (Pietinen 1990) may have favoured the change in blood pressure, along with the rise in polyunsaturated fat consumption (Iacono et al. 1983). The cuff size was lengthened for the 1982 survey, which may have caused overestimation of the change between the 1977 and 1982 surveys.

In the late 1970s and 1980s many national activities were targeted at the prevention of coronary heart diseases in Finland. Thus Kuopio province lost its original function as a control or reference area. Monitoring began in the southwestern area in 1982 to gain a better picture of risk factor developments nationwide, and in the 1992 survey the Helsinki metropolitan area was also included in for the first time (to be reported separately). Thus the system has evolved from evaluation of the North Karelia Project to monitoring of Finland's nationwide trends.

Initially (1972–1977), the major comparison in the effect evaluation of the project was against the neighbouring province of Kuopio. Blood pressure and cholesterol declined more in North Karelia in the

first five year period and smoking in the second five years, since when the developments in these risk factors have been more or less parallel. In 1982 blood pressure and cholesterol levels were still higher in eastern than southwestern Finland, but have diminished during the last ten years. It thus appears that the risk factor profile in Finland is becoming more homogeneous.

The function of demonstration programmes is also changing. Twenty years ago it was important to investigate whether the risk factor profile of the whole community could be changed. Because this has since been demonstrated frequently (Vartiainen et al 1991), the role of community programmes is now more to develop and test innovations designed for further improvements in chronic disease prevention, and to serve as training sites for health professionals. The idea of community programmes has successfully entered general public health consciousness. In many countries the national strategy for cardiovascular disease prevention is based at least partly on demonstration programmes, a development which is stressed in the WHO/CINDI programme.

The findings overall show there has been a major decline in risk factor levels, which was particularly steep in North Karelia during the initial project years. Thereafter, and associated with numerous nationwide activities, major risk factor reductions have occurred throughout Finland. It is also clear that the sustained activity in the demonstration area of North Karelia continues to be reflected in marked persistence of the initial changes, and with fresh efforts towards further improvements.

REFERENCES

Abramson IH, Gofin R, Hopp C, Gofin J, Donchin M, Habib J. Evaluation of a community program for the control of cardiovascular risk factors: the CHAD program in Jerusalem. Isr J Med Sci 1981;17:201–12.

Feruglio GA, Vanuzzo D, Di Muro G, et al. The Martignacco Project: A community study. Outlines and preliminary results after four years. Giorn Arterioscl 1983;2:207–17.

Fortmann SP, Williams PT, Hulley SB, et al. Effect of health education on dietary behaviour: The Stanford Three Community Study. Am J Clin Nutr 1981;34:2030–8.

Gutzwiller F, Nater B, Martin J. Community-based primary prevention of cardiovascular disease in Switzerland: methods and results of the National Research Project (NAP 1A). Prev Med 1985;14:482–91.

Heinemann L, Heine H, Eckstein M, Hellmund W. Project Schleiz – Nationales Demonstrationsprojekt befolkerungsweiter Prevention bei Herz-Kreislauf- und anderen nicht bertragbaren Krankheiten. Z Klin Med 1986;41:536–9.

Iacono JM, Puska P, Doughtery RM, et al: Effect of dietary fat on blood pressure in rural Finnish population. Am J Clin Nutr 1983;38:860–9.

Keys A: Coronary heart disease in seven countries. Am Heart Ass Monograph No. 29, New York, 1970.

Koskinen EH: The food consumption and nutrient intake of Finns in 1967 to 1969. Helsinki: Report of the Social Insurance Institute 1975; ML:6.

Leppo K, Vertio H. Smoking control in Finland: a case study in policy formulation and implementation. Health Promotion 1986;1:5–16.

Lipid Research Clinics Program. The Lipid Research Clinics Coronary Primary Prevention Trial Results. 1. Reduction in incidence of coronary heart disease. JAMA 1984;251:351–364.

Nutrition policy in Finland. Country paper prepared for the FAO/WHO International Conference on Nutrition in Rome 1992. Ministry of Agriculture and Forestry. Publication 1992:11. Helsinki University Printing House. Helsinki 1992

Nüssel E, Scheidt R, Morgenstern W, Scheuermann W, Bergdolt H. Risikofaktoren der koronaren Herzkrankheit-Ansatze zur Korrektur. In: Morl, Dieham, Heusel, (eds). 45 Jahren Herzinfarkt- und Fettstoffwechsel-Forschung. Berlin, Heidelberg: Springer-Verlag, 1988.

Pietinen P, Uusitalo U, Vartiainen E, Tuomilehto J: Dietary surveys of FINMONICA project in 1982. Acta Med Scand 1988;(suppl) 728:167–77.

Pietinen P: Changing dietary habits in the population: the Finnish experience.In: Lipids and health pp 243–56. Editor: G Ziant. Elsevier Science Publishers B.V. (Biomedical Divison), 1990.

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J et al: Community control of cardiovascular diseases: The North Karelia Project. World Health Organization, Regional Office for Europe,Copenhagen 1981.

Puska P, Salonen JT, Nissinen A, Tuomilehto J, Vartiainen E, Korhonen H, Tanskanen A, Rönnqvist P, Koskela K, Huttunen J: Change in risk factors for coronary heart disease during 10 years of a community intervention programme (The North Karelia Project). Br Med J 1983;287: 1840–1844.

Puska P, Nissinen A, Tuomilehto J, Koskela K, McAlister A, Kottke TE, Maccoby N, Farquhar JW: The community-based strategy to prevent coronary heart disease: conclusions from the ten years of the North Karelia Project. Ann Rev Public Health 1985;6:147–93.

Salomaa V, Arstila M, Kaarsalo E, Ketonen M, Kuulasmaa K et al: Trends in the incidence of and mortality from coronary heart disease in Finland, 1983-1988. Am J Epidemiol 1992;136:1303–15.

SPSS Base System User's Guide. SPSS Inc 1990.

Tuomilehto J, Geboers J, Salonen J, Nissinen A, Kuulasmaa K, Puska P. Decline in cardiovascular mortality in North Karelia and other parts of Finland. Br Med J 1986;293:1068–71.

Tuomilehto J, Puska P, Korhonen H, Mustaniemi H, Vartiainen E, Nissinen A, Kuulasmaa K, Niemensivu H, Salonen JT: Trends and determinants of ischemic heart disease mortality in Finland: with special reference to a possible levelling off in early 1980s. Int J Epidemiology 1989; 18 (suppl 1) S109–S117.

Vartiainen E, Korhonen HJ, Pietinen P, Tuomilehto J, Kartovaara L, Nissinen A, Puska P: Fifteen-year trends in coronary risk factors in Finland, with special reference to North Karelia. Int J Epidemiol 1991;3(20):651–662.

Vartiainen E, Tossavainen K, Viri L, Niskanen E, Puska P: The North Karelia Youth Programs. In: Hyperlipidemia in children and development of atherosclerosis. Annals of the New York Academy of Science. Williams CL, Wynder EL (Eds) 1991;623:332–49.

Vartiainen E, Heath G, Ford E: Assessing population-based programs to reduce blood cholesterol level and saturated fats. Int J of Technology Assessment in Health Care 1991;(7:3):315–326.

7. HYPERTENSION CONTROL

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1. INTRODUCTION

The association between hypertension control and cardiovascular morbidity and mortality was first exposed in the 1960s (Veterans Adminstration Cooperative Study, 1967 and 1970). At the same time, studies were revealing that the control of hypertension at the community level remained a considerable problem. In many countries roughly half of the hypertensive individuals at the general population level were aware of their elevated blood pressure; half of these were under treatment, and half of those under treatment were adequately controlled (Wilberg and Barrow 1972, Hypertension detection and follow-up cooperative study group 1978). In the early 1970s this was also the prevailing situation in North Karelia (Tuomilehto et al. 1980).

In 1971 the WHO expert group proposed a cooperative study of community-based pilot programmes for hypertension control (WHO 1971). It was emphasized that pilot programmes should first be established and carefully evaluated before a nationwide programme was implemented. A total of 16 centers joined the study. One of these was North Karelia, where a hypertension programme was an integral part of the North Karelia Project.

2. THE HYPERTENSION PROGRAMME OF THE NORTH KARELIA PROJECT

The overall objective of the hypertension programme was to reduce the prevalence of high blood pressure in the population of North Karelia, especially among the middle-aged. The specific objectives were: 1) to detect as many hypertensive people as possible; 2) to control blood pres-

sure in as many of them as possible; 3) to establish uniform and appropriate diagnostic and therapeutic methods among physicians; and 4) to gather information on the epidemiology of hypertension and on hypertension-related functions of the health services.

Hypertension programme activities were targeted at the entire population, and at reorganizing the care of hypertensive patients.

2.1. Health education

Hypertension mostly fell within the project's general health education programme. The specific issues targeted for improved public awareness were:

- hypertension as a risk factor for cardiovascular diseases
- the importance of proper treatment for hypertension
- the services offered for screening, treatment and monitoring of hypertension.

The public got the majority of its health education from newspapers and the radio. Most of the educational material on hypertension was given to individuals with high blood pressure visiting the health centers, which were also free to pass on relevant material supplied to them by interest groups such as pharmaceutical companies and the Finnish Heart Association.

2.2. Services for hypertensive individuals

The hypertension programme was integrated into existing health care. Special hypertension clinics were set up in each local health center to deal with the influx of hypertensive visitors. The clinics were run by public health nurses who were trained by the project and assumed the principal responsibility for monitoring. The nurses also offered training to the local health personnel that emphasized the importance of streamlining the activities planned. The training goals were to standardize physicians' diagnostic and therapeutic methods and practices, and to unify the techniques employed by nurses for the monitoring and health education of hypertensive patients. Training of the health personnel took the form of seminars, written guidelines and personal contacts.

Hypertension cases

One of the first tasks of the intervention was to register the hypertensive patients already in contact with health services. Thereafter, detection was a gradual process based on the systematic blood pressure measurement of everyone visiting a physician or public health nurse in the area who had not been checked recently. Actual screening programmes were often run simultaneously. For example, blood pressure was measured at the obligatory x-ray screening for pulmonary tuberculosis, at the health examination for general cardiovascular risk in men, at cervical cancer screening, and at other ad hoc screening procedures.

Treatment and monitoring of patients

Most of the patients were seen at a local health center, where physicians were responsible for the diagnosis and treatment. Very few hypertensive patients were treated at hospital. It was realized at the planning stage that it would be impossible to organize the monitoring of hypertensive patients solely through physician-based activities, and that the public health nurses would be capable of performing this task. The hypertension clinics were thus established in the health centers. If a person had elevated blood pressure in the screening, he or she was asked to visit the hypertension clinic for re-measurement. During these visits (usually three), the nurse inquired about the medical history, and checked smoking, dietary and exercise habits, consumption of salt and drugs etc. If elevated blood pressure persisted at the third re-measurement, the nurse advised the subject to visit the physician.

The physician's appointment involved checking the medical history, taking samples for laboratory tests and performing a clinical examination. The physician decided on any necessary treatment and the intensity of monitoring. Hypertensive patients usually visited the physician twice a year and the public health nurse two or three times.

The health education material given to hypertensive persons in the clinics covered the following issues:

- elevated blood pressure as a risk factor for cardiovascular diseases,
- the importance of the proper treatment for high blood pressure,
- the importance of regular monitoring,

- the role of smoking and diet on the development of cardiovascular diseases,
- the influence of weight reduction on blood pressure level.

The possible benefit to blood pressure of reducing salt consumption was not included in health education until the late 1970s.

2.3. Information system

The hypertension register of the North Karelia project was established at the start of the programme to serve its overall evaluation needs. The purpose was to register all hypertensive persons in North Karelia and serve the process of monitoring them (Nissinen et al. 1981). By 1988 some 22 000 hypertensives had been recorded in the project's register for North Karelia. The register was used to ensure annual follow-ups and to accumulate the respective monitoring data.

In addition to this, each public health nurse in the hypertension clinics kept her own manual record of routine work. This included a patient card for each subject, where observations were made during each visit. The hypertension register, by contrast, was updated only once a year. Another component of the information system was a personal notebook given to each hypertensive patient upon registration. The subject was advised to show the notebook in contacts with health personnel, thereby informing physicians and nurses that he/she was already registered.

2.4. Evolution of the hypertension programme

The hypertension programme evolved comprehensively over the two decades. Reorganizing the hypertension control services took place during the first two years of the project, while the training of health care personnel has been continuous since the 1970s. This has included instruction in practical programme tasks as well as pharmacological and other aspects of hypertension control. In 1978–1982 a new venture was established: the North-Karelia Salt Project. This focused on the primary prevention of hypertension by attempting to influence salt intake among the general population (Tuomilehto et al. 1981, 1984).

After 1982 the operation of the provincial register ceased and the monitoring of hypertensives was left to the health centres, with continuous background support from the project. There has since been increasing orientation towards the non-pharmacological control of hypertension: salt and weight reduction, and changes in the amount and quality of dietary fat.

3. RESULTS

Significant reductions in systolic and diastolic blood pressure were observed among the middle-aged North Karelians during the first five years of the programme (Tables 7.1 and 7.2). No major changes took place over the next decade, but a further downward trend was recorded between 1987–1992 in Kuopio province as well as North Karelia.

Sex and age (years)	North Karelia					Kuopio				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
Men										
30–39	144±17	140±16	140±16	140±16	136±14	141±16	141±16	143±16	141±16	137±16
40–49	147±19	143±18	141±18	142±17	140±19	146±21	146±20	145±18	143±18	139±17
50–59	156±24	146±19	152±21	149±21	149±22	152±24	150±21	153±20	150±20	145±20
Total	149±21	143±18	145±19	144±19	141±19	146±21	146±19	147±18	144±19	140±18
Women										
30–39	138±18	130±16	132±16	129±15	126±16	132±16	131±16	133±15	128±14	124±15
40–49	152±24	141±19	142±20	136±18	134±19	146±22	143±20	142±19	139±21	135±19
50–59	167±27	152±21	149±19	150±22	146±23	164±27	155±23	155±24	149±21	150±23
Total	153±26	141±21	141±20	139±21	135±21	147±26	143±22	143±22	139±20	135±22

3-way ANOVA	p
Area	.489
Time	.000
Sex	.000
Area * Time	.000
Area * Sex	.037
Time * Sex	.000
Area * Time * Sex	.105

Table 7.1. Mean casual systolic blood pressure (mmHg ± standard deviation) in North Karelia and Kuopio province by sex and age in 1972–1992

Sex and age (years)	North Karelia					Kuopio				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
Men										
30–39	90±11	86±11	83±13	84±11	80±10	91±10	89±11	86±13	87±10	80±12
40–49	92±12	90±11	87±12	90±12	86±13	94±12	94±12	90±13	89±11	85±12
50–59	94±13	90±11	90±12	90±12	88±13	95±13	95±12	92±13	91±11	86±10
Total	92±12	89±11	87±13	88±12	85±12	93±12	93±12	89±13	89±11	84±12
Women										
30–39	86±12	81±10	80±11	78±11	75±10	86±10	83±10	80±10	79±10	74±11
40–49	92±13	87±10	86±12	84±10	81±11	91±11	89±11	85±11	85±11	81±12
50–59	98±13	90±11	88±12	87±11	83±11	97±13	93±12	89±12	88±10	85±10
Total	92±14	86±11	84±12	83±11	80±11	91±12	88±12	85±12	84±11	80±12

3-way ANOVA	p
Area	.000
Time	.000
Sex	.000
Area * Time	.000
Area * Sex	.000
Time * Sex	.000
Area * Time * Sex	.000

Table 7.2. Mean casual diastolic blood pressure (mmHg ± standard deviation) in North Karelia and Kuopio province by sex and age in 1972–1992

The proportion of hypertensive persons aware of their condition has risen clearly and similarly in both areas since the early 1970s. The majority of people in both areas have been aware of their condition, though women more often than men (Table 7.3).

The proportion of men on antihypertensive drug treatment has risen in North Karelia from 4% to 12% over the 20 year period, while that of women declined to 8 % between 1977 and 1992 (Table 7.4).

For data analysis purposes, subjects whose casual blood pressure reached 160 mmHg systolic and/or 95 mmHg diastolic, or who were currently on antihypertensive drug treatment, were defined as hypertensive. In 1972, 44% of the North Karelian men were hypertensive by this definition, while by 1992 this proportion had fallen to 30%. The decline among women was from 49% in 1972 to 22% in 1992 (Table 7.5).

To illustrate the changing efficiency of hypertension care in the two provinces, hypertensive persons were divided into four categories: 1) untreated and unaware of being hypertensive, 2) untreated but aware

Sex and age (years)	North Karelia					Kuopio				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
Men	%	%	%	%	%	%	%	%	%	%
30-39	22	60	56	53	76	18	42	35	45	55
40-49	28	62	57	69	71	29	50	53	59	76
50-59	41	68	63	70	79	36	59	56	63	71
Total	32	64	60	66	76	29	51	49	58	70
Women										
30-39	57	83	78	83	91	51	65	63	75	85
40-49	58	78	72	81	73	54	77	79	71	85
50-59	60	81	72	71	75	59	73	66	77	81
Total	59	80	73	75	76	56	73	69	75	82

Table 7.3. The proportion of hypertensive persons aware of having elevated blood pressure in North Karelia and Kuopio province by sex and age in 1972–1992

Sex and age (years)	North Karelia					Kuopio				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
Men	%	%	%	%	%	%	%	%	%	%
30-39	1	4	2	3	2	1	3	2	3	2
40-49	3	9	9	8	10	4	9	7	9	14
50-59	8	18	20	20	24	8	19	16	16	18
Total	4	10	11	11	12	4	10	8	9	12
Women										
30-39	1	4	2	1	1	2	2	1	2	1
40-49	7	12	8	9	7	7	13	9	5	7
50-59	21	27	20	20	16	18	24	19	21	25
Total	10	14	10	10	8	9	13	10	10	10

Table 7.4. The proportion of persons under antihypertensive drug treatment among the entire population in North Karelia and Kuopio province by sex and age in 1972–1992

of being hypertensive, 3) treated but blood pressure not controlled (systolic blood pressure ≥160 mmHg and/or diastolic ≥95 mmHg), and 4) treated and blood pressure adequately controlled (systolic blood pressure ≥160 mmHg and diastolic ≥95 mmHg). Table 7.6 shows the resulting distribution over the 20 year period of the project.

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Sex and age (years)	North Karelia					Kuopio				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
Men	%	%	%	%	%	%	%	%	%	%
30-39	36	19	22	24	11	35	30	30	26	18
40-49	41	32	36	37	29	47	41	45	40	35
50-59	57	40	53	53	50	53	51	55	51	42
Total	44	30	38	39	30	45	40	42	39	32
Women										
30-39	25	10	12	9	6	18	11	11	9	6
40-49	47	26	32	24	20	43	33	28	24	21
50-59	75	47	47	47	38	66	52	57	48	48
Total	49	28	31	27	22	42	32	32	27	24

*Hypertensive person: systolic blood pressure ≥160 mmHg and/or diastolic blood pressure ≥95 mmHg or under hypertensive drug treatment

Table 7.5. The proportion of hypertensive persons in North Karelia and Kuopio province by sex and age in 1972–1992*

Sex and age (years)	North Karelia					Kuopio				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
Men										
R1	67	36	40	34	24	72	49	51	43	30
R2	24	31	31	36	35	19	27	30	33	34
R3	7	25	20	19	25	8	22	14	19	18
R4	2	8	9	11	16	1	3	4	5	19
Women										
R1	42	20	27	25	24	44	27	31	25	18
R2	39	29	39	37	39	35	32	38	39	39
R3	18	34	24	20	17	19	32	19	25	22
R4	2	17	10	18	20	2	9	12	12	22

* Hypertensive person: systolic blood pressure ≥160 mmHg and/or diastolic blood pressure ≥95 mmHg or under hypertensive drug treatment.

R1 = Not aware of hypertension
R2 = Aware of hypertension, not treated with antihypertensive drugs
R3 = Treated, high blood pressure*
R4 = Treated, normal blood pressure

Table 7.6. Development of hypertension care among hypertensive persons in North Karelia and Kuopio province by sex in 1972–1992*

4. DISCUSSION

The hypertension control programme of the North Karelia project was found to be both feasible and effective: hypertension care improved markedly and hypertension was brought under control in a considerable proportion of hypertensive persons during the period from 1972 to 1977 (Tuomilehto et al. 1980, Nissinen et al. 1981, Nissinen et al. 1983). The programme had a clearly favourable effect on the blood pressure control of hypertensive persons in the community and on the general blood pressure level of the population as a whole. During the follow-up period 1977 to 1982, hypertension care was maintained but no further improvements noted.

In the province of Kuopio, the initial reference area, the improvement in hypertension care began later, and more or less in line with the nationwide trend during the observation period (Nissinen et al. 1988). Between 1982 and 1987 there was still some progress occurring in the realm of hypertension diagnosis and treatment, although the proportion of unsatisfactorily treated patients was still high (Salomaa et al. 1989). The most recent data from 1987 to 1992 reveal a clearer improvement in hypertension care than in the previous five year period.

Overall, most of the favourable trend in hypertension is probably due partly to the reorganizing of the hypertension care system and partly to the intensive health education in the community. Health education has resulted in marked improvements in health behaviour such as smoking and dietary habits, both in North Karelia and other parts of Finland.

A factor which may well have had a significant moderating influence in this context is the change in hypertension care policies which took place between 1977 and 1982. The new nationwide recommendations introduced in 1977 contained relatively strict eligibility criteria for free antihypertensive drug treatment, which meant that in practice drug treatment was initiated at higher blood pressure threshold levels than before. These new criteria probably resulted in fewer treated patients, especially among women between 1977 and 1982.

Over the two decades of the project, certain life-style changes have taken place in North Karelia which may have had deleterious effects on hypertension control. The North Karelia Salt Project of 1979–1982 was an attempt at primary prevention (Tuomilehto et al. 1981, 1984). The

daily salt intake among the province's population was high, but the subsequent three year intervention programme had no influence on mean salt intakes. The dietary changes that resulted in decreases in the mean serum cholesterol level in North Karelia (Puska et al. 1983) may have had a minor effect on blood pressure levels; but on the other hand the considerable rise in the body weight of men may well have counterbalanced the efforts to lower blood pressures. The increase in alcohol intake in Finland during the 1970s may also have had a deleterious influence on blood pressure control (Tuomilehto et al. 1984).

Despite the favourable development overall, the community control of hypertension still remains unsatisfactory in North Karelia. A further large increase in the number of people on drug treatment is obviously not the prime solution, since over 10% of 30–59 year-old citizens are already on antihypertensive drug therapy. On the other hand, the quality of care among those on drug treatment could be better, with more attention being paid to maximizing treatment benefits through the achievement of improved compliance and better evaluation of the effects of drug treatment. More information is also needed on non-pharmacological means for preventing and lowering high blood pressure. General measures combined with effective drug treatment and monitoring provide the foundation for the control of hypertension in populations.

REFERENCES

Hypertension Detection and Follow-up Cooperative Study Group. Mild hypertensives in the hypertension detection and follow-up program. Ann NY Acad Sci 1978;304:254–266.

Nissinen A, Tuomilehto J, Elo J et al. Implementation of a hypertension control program in the County of North Karelia, Finland. Public Health Reports 1981;96:503–514.

Nissinen A, Tuomilehto J, Elo J et al. North Karelia (Finland) Hypertension Detection Project. Five-year follow-up of hypertensive cohort. Hypertension 1983;5:564–572.

Nissinen A, Tuomilehto J, Korhonen H et al. Ten-year result of hypertension care in the community. Follow-up of the North Karelia Hypertension Control Program. Am J Epidemiol 1988;127:488–499.

Puska P, Iacono J, Nissinen A et al. Controlled, randomized trial of the effect of dietary fat on blood pressure. Lancet 1983;1:1–5.

Salomaa V, Tuomilehto J, Nissinen A et al. The development of hypertension care in Finland from 1982 to 1987. J Hypertens 1989;7:837–844.

Tuomilehto J, Nissinen A, Salonen JT et al. Community programme for control of hypertension in North Karelia, Finland. Lancet 1980;2:900–904.

Tuomilehto J, Puska P, Nissinen A et al. Community-based prevention of hypertension in North Karelia, Finland. Ann Clin Res 1984;16(Suppl 43):18–27.

Tuomilehto J, Puska P, Tanskanen A et al. A community-based intervention study on the feasibility and effects of the reduction of salt intake in North Karelia, Finland. Acta Cardiol 1981;36:83–104.

Veterans Administration Cooperative Study Group on Antihypertensive Agents. Effects of treatment on morbidity in hypertension: results in patients with diastolic blood pressure averaging 115 through 129 mmHg. JAMA 1967;202:1028–1034.

Veterans Administration Cooperative Study Group on Antihypertensive Agents. Effects of treatment on morbidity in hypertension: II. results in patients with diastolic blood pressure averaging 90 through 114 mmHg. JAMA 1970;213:1143–1152.

Wilberg J, Barrow J. Hypertension – a community problem. Am J Med 1972;52:653–663.

World Health Organization. Community control of stroke and hypertension. Report of a WHO meeting CVD/72.1. Gothenburg 1971.

8. DIETARY CHANGES

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1. INTRODUCTION

The nutrition programme of the North Karelia Project was originally developed as part of the overall intervention to reduce total cholesterol levels in the population. The intermediate objectives were to achieve a reduction in saturated fat intake, to promote substitution of saturated fat by unsaturated fat, and to increase vegetable consumption.

In the late 1960s and early 70s the Finnish diet was very high in dairy fats and low in vegetables, especially in rural areas such as North Karelia. Large dietary surveys carried out during 1969–1972 had revealed that total fat provided about 38 %, saturated fat 21 % and polyunsaturated fat only 3 % of energy (Koskinen 1975, Hasunen et al. 1976). North Karelia was a traditional dairy farming region and at that time two-thirds of total fat intake was derived from milk and milk products, including butter.

Although the North Karelian diet was known to be very salty, interest in salt consumption as a possible public health problem did not emerge until the late 1970s. The first study on sodium excretion among elderly men of east and west Finland showed that salt intakes were above 15 g in the east and about 14 g in the west (Karvonen and Punsar 1977). In 1979 a community-based programme to reduce salt consumption was initiated in North Karelia (Tuomilehto et al. 1981). The aim of this three-year salt project was to evaluate the feasibility and effects of salt intake reduction in the whole population. Intervention was integrated into the existing health care structure without the need for extra resource allocation. The strategies included health education of the whole population, and of hypertensive patients in particular, training of health personnel, and environmental modification (Nissinen et al. 1982).

The 1987 population survey found that the decrease in population cholesterol means had levelled off. Novel and intensified activities began in North Karelia and across the country, coinciding with new national cholesterol guidelines. A variety of rapeseed oil developed in Finland was actively promoted. Cholesterol measuring (partly by the finger-tip method) was provided in North Karelia to support the dietary counselling. There was also lively collaboration with food manufacturers and supermarkets in the development and promotion of low fat, "cholesterol-lowering" foods.

This chapter describes the relevant changes in North Karelia based on data from the 1972 to 1992 surveys.

2. METHODS

Dietary habits were studied in the population surveys conducted at 5-year intervals from 1972. The survey questionnaire has included about 20 multiple choice questions on dietary habits. Most were qualitative or frequency questions, but the consumption of milk, coffee, tea and bread, as well as the amount of fatty spread used on bread, were assessed quantitatively. A rough indicator of fat intake was derived by calculating the saturated fatty acids derived from milk and from the fat used on bread (Pietinen et al. 1988).

The baseline survey of the salt project was carried out separately in 1979 (Tuomilehto et al. 1981), but the follow-up was integrated into the general risk factor surveys of 1982, 1987 and 1992. In 1979, 1982 and 1987 the assessment of salt intake was made in a sub-sample of the survey participants using the 24-hour urine collection method (Pietinen et al. 1984, 1989). In 1992 salt intake was calculated based on three-day food records (Kleemola et al. 1994).

No detailed dietary surveys were carried out in the 1970s within the North Karelia Project. Information on dietary composition in the early 70s was obtained via the two large surveys performed by the Social Insurance Institution during 1967–1969 and 1969–1972 (Koskinen 1975, Hasunen et al. 1976). A dietary survey was carried out in 1982 (Pietinen et al. 1988) and 1992 (Kleemola et al. 1994) using three-day food records and an approximately 30 % subsample of the survey participants; 1348

subjects participated in 1982 and 1861 in 1992. The 1982 and 1992 survey covered the 25–64 year old population in North Karelia, Kuopio and southwestern Finland, and in 1992 the Helsinki metropolitan area was also included in the study.

3. RESULTS

The type of milk consumed has changed substantially over the period 1972–1992 (Figure 8.1). Low-fat milk (1.9 % fat) became the most popular type of milk back in the 1970s, with skim milk (0.05 % fat) slowly gaining popularity in the late 80s. In 1992 15 % of men and 19 % of women in North Karelia used skim milk. High-fat milk (3.9 % fat or over) is consumed by only 20 % of men and 11 % of women in North Karelia. Kuopio has experienced very similar trends.

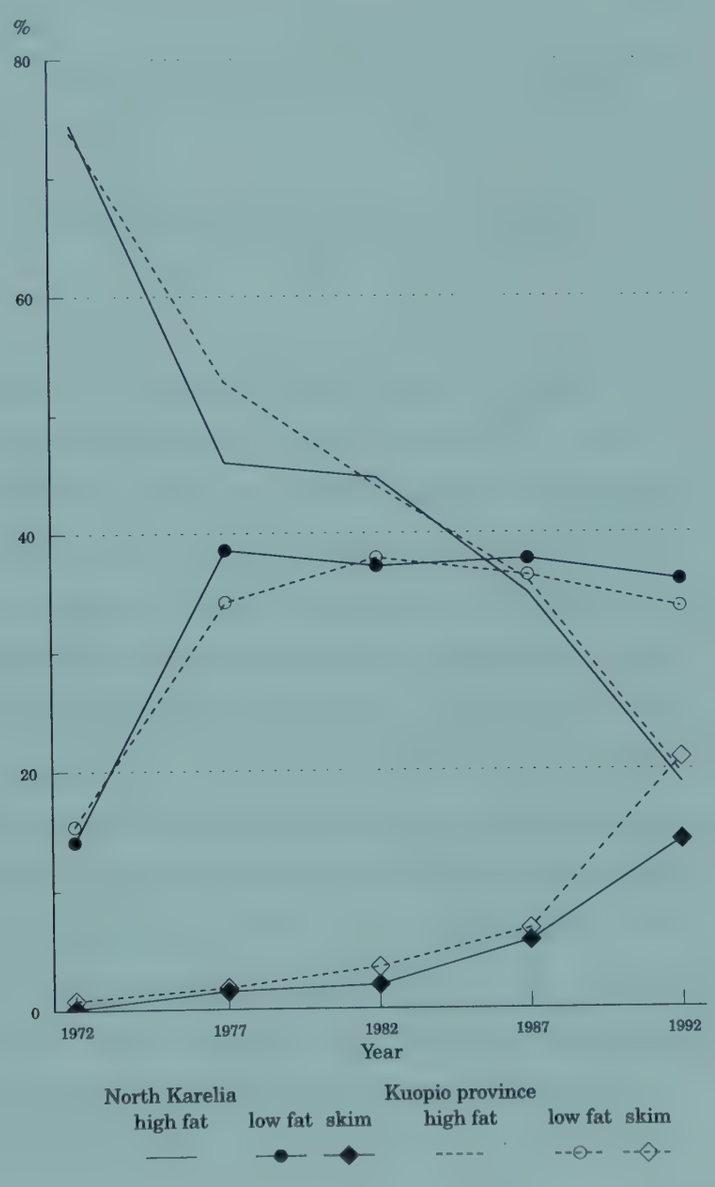

Figure 8.1. Use of high fat, low fat and skim milk in men

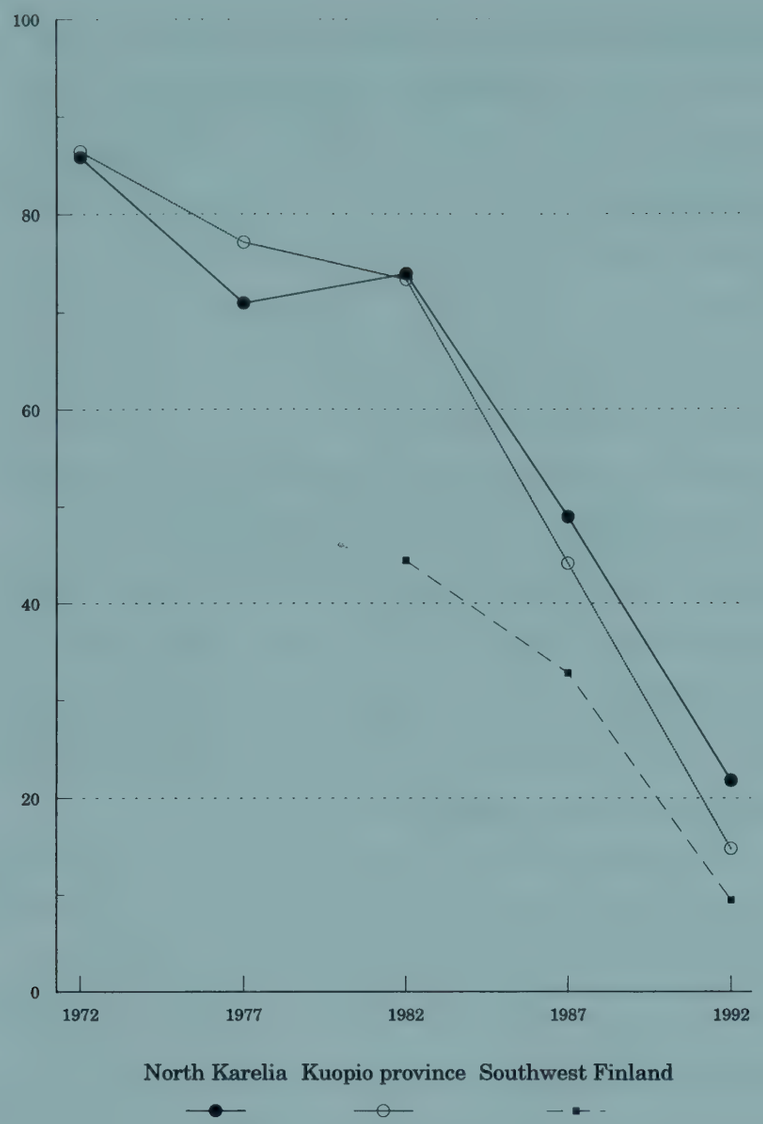

Figure 8.2. Use of butter on bread in men

The type of fat used on bread has also changed markedly (Figure 8.2). In 1972, over 80 % of the population of eastern Finland used butter on bread, while by 1992 only 22 % of men and 14 % of women in North Karelia were using butter. Soft vegetable margarines and butter-oil mixtures are now the most popular products. Low-fat spreads containing only 40 % fat became available in 1987, and by 1992 were consumed by 22 % of men and 27 % of women in North Karelia. The amount of fat used on a slice of bread has also decreased substantially (Figure 8.3). It was almost 9 g among men in 1972, but less than 5 g in 1992, when 9 % of men and 13 % of women reported eating bread with no spread.

The daily intake of saturated fatty acids from milk and fat used on bread is shown in Figure 8.4. Over the 20 years, this intake score of saturated fatty acids has declined among men from 49 g per day to 17 g in North Karelia and from 42 g to 17 g in Kuopio. The respective changes among women were from 27 g to 8 g in North Karelia and from 23 g to

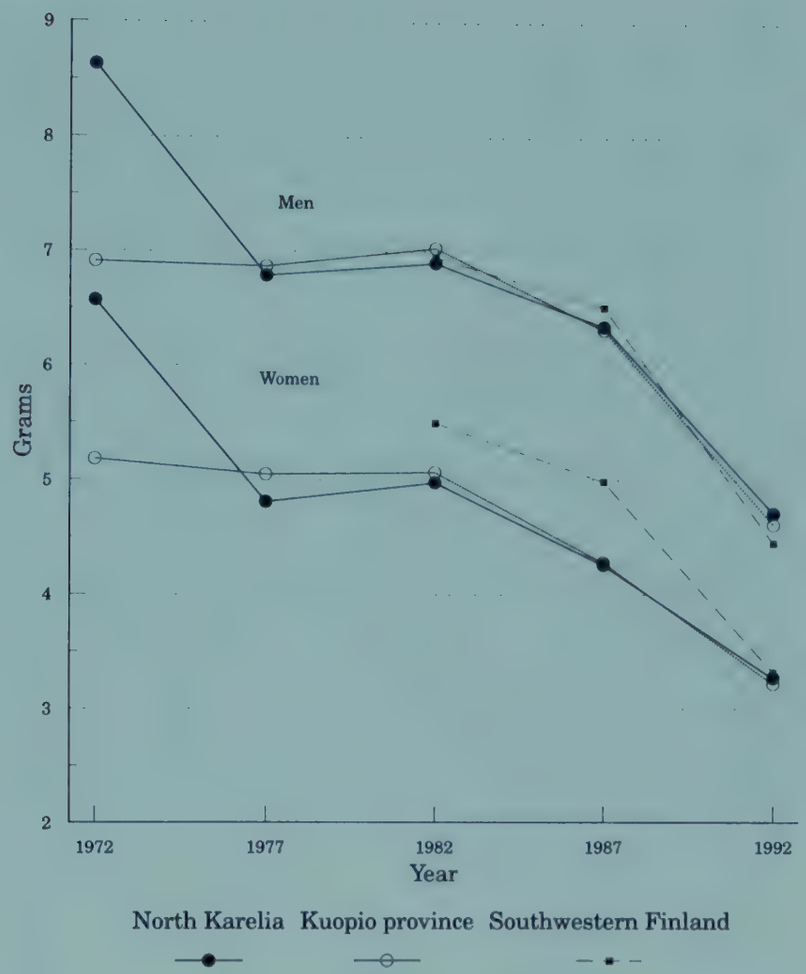

Figure 8.3. Amount of fat used on bread

8 g in Kuopio. During the first five years the decline in saturated fat consumption was greater among North Karelians.

Changes in the composition of the diet based on the dietary surveys of 1982 and 1992 are shown in Tables 8.1 and 8.2. Total fat still provided 38 % of energy for men in 1982, but there was a decline to 34-35 % by 1992. This development can be attributed to a decrease in saturated fat intake from 20 % to 15–16 % of energy. The proportion of monounsaturated fats in men has been very stable, at 12–13 % of energy, and polyunsaturated fats have increased only slightly, from about 4 % to 5 %. The intake of dietary cholesterol has declined in all areas to about 400 mg. The changes are very similar in women, except that the proportion of total fat was already lower in 1982 and has declined further than in men. In 1992, total fat provided 33 % of energy in both North Karelia and Kuopio, and 35 % in southwestern Finland.

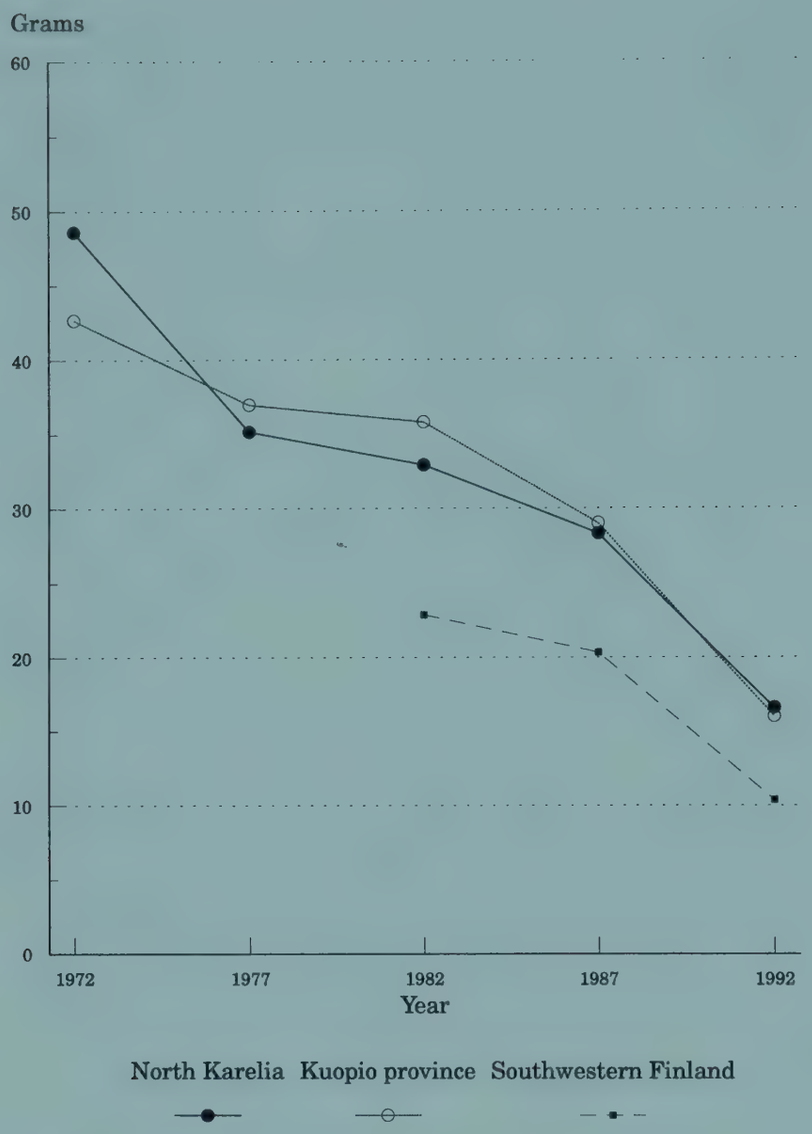

Figure 8.4. Daily intake of saturated fats from milk and from fat used on bread in men

The mean values for salt intake from 1979 to 1992 are shown in Table 8.3. More detailed data are reported in the individual articles referred to below. The results of the salt project in 1982 showed that the three years of intervention had no effect (Tuomilehto et al. 1984, Pietinen et al. 1984). However, a decreasing trend between 1979–1987 was observed (Pietinen et al. 1989). In North Karelia, 24-hour sodium excretion fell by 9 % in men and 16 % in women, and in Kuopio by 9 % in both sexes. Based on the 1992 survey, where sodium intake was calculated from the three-day food records, the downward trend continued (Kleemola et al. 1994). However, since the methodology differed from that used in the preceding survey it is difficult to assess the magnitude of the change precisely. From 1979 to 1987 salt intake was measured by 24-hour sodium excretion and the values in the table are direct transformations from sodium to sodium chloride, while in 1992 sodium intake was estimated from the food records. Since sodium excretion is only

MEN	AREA						
	NORTH KARELIA		KUOPIO PROVINCE		TURKU-LOIMAA		P-VALUE
	N= 208	N=204	N=212	N=236	N=233	N=225	
	1982	1992	1982	1992	1982	1992	
ENERGY, KCAL	2958	2551	2860	2657	2809	2360	n.s.[1]
PROTEIN	15.0	16.4	14.8	16.4	14.4	16.0	n.s.[1]
FAT	38.0	34.0	38.6	33.7	38.9	35.2	n.s.[1]
- SAFA	20.0	15.6	20.2	15.6	19.1	15.9	* [1]
- MUFA	12.7	12.4	12.9	12.2	13.5	13.1	n.s.[1]
- PUFA	4.4	5.0	4.5	5.0	5.3	5.3	* [1]
P/S-RATIO	0.25	0.35	0.25	0.35	0.31	0.36	* [2]
CARBOHYDRATE	45.1	46.9	44.3	46.7	43.9	44.7	n.s.[1]
- SUCROSE	8.1	9.3	8.0	9.6	8.3	9.4	n.s.[1]
ALCOHOL	1.8	2.7	2.3	3.2	2.8	4.0	n.s.[1]
CHOLESTEROL, MG	527	408	551	428	501	406	** [2]

p-value * p<0.05, ** p<0.01, p<0.001

[1] Adjusted for age
[2] Adjusted for age and energy

Table 8.1. Energy and cholesterol intake, the percentage distribution of energy intake from fat, protein, carbohydrate and alcohol (E%) and P/S-ratio in 1982 and 1992.

WOMEN	AREA						
	NORTH KARELIA		KUOPIO PROVINCE		TURKU-LOIMAA		P-VALUE
	N=235	N=250	N=211	N=272	N=249	N=245	
	1982	1992	1982	1992	1982	1992	
ENERGY,KCAL	2135	1940	2094	1871	1991	1882	n.s.[1]
PROTEIN	14.9	16.6	15.1	16.3	15.1	16.2	n.s.[1]
FAT	36.0	32.9	36.5	32.9	38.0	34.9	n.s.[1]
- SAFA	19.0	14.9	19.6	15.4	18.5	16.1	*** [1]
- MUFA	12.0	11.9	12.1	11.7	13.1	12.4	n.s.[1]
- PUFA	4.3	5.2	4.1	4.9	5.3	5.2	*** [1]
P/S-RATIO	0.26	0.37	0.23	0.34	0.31	0.35	*** [2]
CARBOHYDRATE	48.7	49.4	47.9	49.8	45.5	47.4	n.s.[1]
- SUCROSE	9.1	10.8	9.0	10.9	8.6	10.6	n.s.[1]
ALCOHOL	0.5	1.1	0.5	1.0	1.4	1.5	n.s.[1]
CHOLESTEROL, MG	374	318	387	294	365	310	n.s.[2]

p-value * p<0.05, ** p<0.01, p<0.001

[1] Adjusted for age
[2] Adjusted for age and energy

Table 8.2. Energy and cholesterol intake, the percentage distribution of energy intake from fat, protein, carbohydrate and alcohol (E%) and P/S-ratio in 1982 and 1992.

	MEN				WOMEN			
YEAR	**1979**	**1982**	**1987**	**1992**	**1979**	**1982**	**1987**	**1992**
NORTH KARELIA								
MEAN	13.0	13.9	12.2	12.2	10.6	10.0	8.9	8.8
N	268	247	211	204	268	237	216	250
KUOPIO PROVINCE								
MEAN	13.2	13.1	12.0	12.3	10.5	10.3	9.5	8.2
N	343	216	183	236	327	216	224	272
SOUTH-WEST FINLAND								
MEAN	–	11.9	12.4	10.8	–	9.1	9.1	8.0
N	–	232	116	225	–	238	209	245

The 1979, 1982 and 1987 values are based on 24-hour urinary sodium excretion.
The 1992 values are based on three-day food records and are age- and energy-adjusted.

Table 8.3. Mean sodium intake expressed as NaCl g from 1979 to 1992.

about 90–95 % of intake, the values from 1979 to 1987 are underestimates. However, since food records are always themselves underestimates of the real food intake, the 1992 values may also be somewhat lower than the true level of salt intake. Nevertheless, it has been determined that salt intakes did decrease between 1979 and 1992, from 13–14 g to 12 g in men and 11 g to 8–9 g in women.

4. DISCUSSION

The past two decades have seen remarkable dietary transitions in North Karelia, and indeed across the entire country. During the first five years the reductions in saturated fat intake were greater in North Karelia than Kuopio. The diet that used to be very high in saturated fat and salt now has one of the lowest fat contents reported in Europe, and an average salt level. Besides widespread nutrition education, the nutrition strategies which made this possible have involved health care personnel, the food and catering industry, and legislation. The comprehensive strategies applied are discussed in other chapters.

Most people eat a hot lunch during their school or working day, and dietary guidelines and recommendations have been drawn up by various authorities, especially during the 1980s. All types of schools, universities, hospitals, work sites, the armed forces and day care facilities are now covered. These guidelines are basically formulated from the

general recommendations of the National Nutrition Council, which are as follows: the maximum fat percentage of energy should be 30 %, the intake of saturated fat should decrease, and the share of polyunsaturated fats should increase to 7 % of energy (P/S ratio 0.5). Sugar intake should not exceed 10 % of energy, salt intake should be 7–9 g at most, and dietary fibre 30–35 g.

Liberalization of regulations on dietary fats has made it possible to manufacture novel spreads by mixing dairy fats and vegetable oils, as well as low-fat spreads. The 1987 law on dietary fats allows producers to make spreads which only contain 40 % or 60 % of fat instead of the regular 80 %. This has prompted an innovative variety of low-fat spreads which have grown immensely popular. New food labelling rules mean that nutrient value declarations can now include the proportion of different fatty acids, and the cholesterol content can also appear on the label. A product can be labelled "light" only if its energy value does not exceed 70 % of that of the usual product. The most important legislation on salt dates from 1992. This lists the maximum salt concentration of soups, sauces and salted mushrooms; it also regulates use of the term "reduced salt content" on labels, and requires "heavily salted" if the salt content of the product is above a stipulated level in butter, sausages, fresh bread and breakfast cereals.

In response to the evolving health consciousness among its customers, the Finnish food industry has pursued the development of new low-fat products with great diligence and creativity. In the 1980s, low-fat milks and spreads were joined by low-fat cheeses, ice creams and sausages etc. The quality of meat has changed dramatically over the 20 years, with lean pork largely replacing fatty pork and beef. Frying and other food preparation methods dependent on fat have declined in favour of boiling and cooking with little or no fat. Oil was little used in food preparation 20 years ago, but became popular in the 1980s. In 1992, about one quarter of households reported using mainly oil in cooking. Finnish rapeseed oil (Canola oil) is now widely used in the margarine industry. Fish and vegetable consumption have risen, especially outside the home. A free salad with meals became the norm in the late 1970s; this revolutionary development has contributed to the doubling of vegetable consumption. The availability of fruits and vegetables has greatly improved, particularly during the past decade, and prices are more reasonable.

The experience in North Karelia and over the country as a whole shows that changing dietary habits significantly is indeed possible. However, modifying lifestyles in a population is a slow and continuous process which takes place in stages and with plateaus in between. Innovative intervention techniques are constantly being sought. Promotion of good nutrition and healthier lifestyles in general needs persistent efforts and effective cooperation between researchers, health educators, legislators and the food industry if genuinely feasible options are to be created for people and to become widely adopted.

REFERENCES

Hasunen K, Pekkarinen M, Koskinen E, Seppänen R, Bäckström LA. The food consumption and nutrient intake in Finland from 1969 to 1972. Report of the Social Insurance Institute 1976;ML9 (in Finnish with an English summary).

Karvonen MJ, Punsar S. Sodium excretion and blood pressure of west and east Finns. Acta Med Scand 1977;202:501–507.

Kleemola P, Virtanen M, Pietinen P. The 1992 dietary survey of Finnish adults. Publications of the National Public Health Institute 1994:B2.

Koskinen EH. The food and nutrient intake of Finns from 1967 to 1969. Report of the Social Insurance Institute 1975;ML6 (in Finnish with an English summary).

Nissinen A, Pietinen P, Tuomilehto J, Tanskanen A, Moisio S, Puska P. Experiments with dietary intervention in hypertension control – implementation of the North Karelia Salt Project. Magnesium 1982;1:232–240.

Pietinen P. Changing dietary habits in the populations: The Finnish experience. In: Ziant G (ed.). Lipids and health. Elsevier Science Publishers, Amsterdam 1990:243–256.

Pietinen P, Nissinen A, Vartiainen E, Tuomilehto J, Uusitalo U, Ketola A, Moisio S, Puska P. Dietary changes in the North Karelia project (1972–1982). Prev Med 1988;17:183–193.

Pietinen P, Uusitalo U, Vartiainen E, Tuomilehto J. Dietary survey of the FINMONICA project in 1982. Acta Med Scand 1988; Suppl 728:169–177.

Pietinen P, Vartiainen E, Korhonen HJ, Kartovaara L, Uusitalo U, Tuomilehto J, Puska P. Nutrition as a component in community control of cardiovascular disease (The North Karelia Project). Am J Clin Nutr 1989;49:1017–1024.

Pietinen P, Tanskanen A, Nissinen A, Tuomilehto J, Puska P. Changes in dietary habits and knowledge concerning salt during a community-based prevention programme for hypertension. Ann CLin Res 1984;16(suppl 53):150–155.

Tuomilehto J, Puska P, Tanskanen A, et al. A community-based intervention study on the feasibility and effects of the reduction in salt intake in North Karelia. Acta Cardiol T 1981;36:83–104.

Tuomilehto J, Pietinen P, Uusitalo U, Korhonen H, Nissinen A. Changes in sodium and potassium intake in Finland during the 1980's. In: Y Yamori and T Strasser (eds.) New horizons in preventing cardiovascular diseases. Elsevier Publishers 1989:229–239.

9. Twenty Year Trends in Cardiovascular Disease Risk Factor Clustering in Eastern Finland

Pekka Jousilahti, Jaakko Tuomilehto, Heikki J. Korhonen, Erkki Vartiainen, Aulikki Nissinen and Pekka Puska

1. INTRODUCTION

Smoking, elevated serum cholesterol and elevated blood pressure are the prime risk factors for CVD (Kannel et al. 1961, Keys 1970, Stamler 1978). The risk increases across the entire blood pressure and serum cholesterol distribution, with an exponential rise associated with very high levels of both. When all three major risk factors are considered simultaneously each contributes independently to the risk of CVD, although clustering of the risk factors may also introduce a synergistic effect which amplifies the risk of each compared to its influence alone (the Pooling Project Research Group 1978).

The main intermediate objectives of the North Karelia Project were to reduce the prevalence of smoking, elevated serum cholesterol and elevated blood pressure in the province's population, with special emphasis on middle-aged men. Kuopio province was the initial reference area.

This chapter describes the 20-year cardiovascular disease risk factor clustering trends in eastern Finland and examines whether high levels of risk factors cluster in the same individuals or are spread evenly across the population.

2. METHODS

Five independent cross-sectional population surveys (in 1972, 1977, 1982, 1987, 1992) have been carried out in North Karelia and Kuopio to eval-

uate the project and to assess cardiovascular disease risk factor levels. The sample sizes, participation rates and survey methods are described in chapter 4.

In the present analyses hypertension was defined as either 160 mmHg or more for systolic blood pressure, or 95 mmHg or more for diastolic blood pressure. Serum cholesterol at 6.5 mmol or above was classified as high. Ex-smokers who had stopped smoking less than one month prior to the survey were considered as smokers; other ex-smokers were treated as non-smokers. The overall mean amount of daily smoking was assessed from the sum of the average number of cigarettes, self-made cigarettes, pipe-fulls and cigars smoked per day by all subjects who reported smoking in the month prior to the survey.

A loglinear procedure was used to test the significance of differences and changes in proportions over time. The method was performed starting from a saturated model and using backwards elimination. Partial age-adjusted correlations were calculated between systolic and diastolic blood pressure, serum cholesterol and the amount of daily smoking, to estimate the degree of risk factor clustering in 1972 and 1992. Among men, mean values of systolic blood pressure, amount of daily smoking and serum cholesterol were also analyzed by dichotomized categories of each of the other two risk factors in 1972, 1987 and 1992. The statistical evaluation, controlled for age, was made using the analysis of covariance.

3. RESULTS

In 1972, the proportion of men with none of the three major cardiovascular disease risk factors was just 13 % in North Karelia and 15 % in Kuopio (Table 9.1); by 1992 the respective rates had risen to 36 % ($p<0.001$) and 35 % ($p<0.001$). Over the same period the proportion of high-risk subjects – those with two or three risk factors combined – decreased from 54 % to 19 % ($p<0.001$) in North Karelia and from 50 % to 22 % ($p<0.001$) in Kuopio. The decline in risk factor clustering was steeper in North Karelia than Kuopio from 1972 to 1977 ($p<0.001$) and slightly greater in Kuopio from 1977 to 1982, while between 1982 and 1992 there was no difference in this trend between the two areas.

	NORTH KARELIA					KUOPIO PROVINCE				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
No risk factors	13 (12-15)	23 (21-25)	27 (25-30)	29 (27-32)	36 (32-40)	15 (14-17)	20 (19-22)	24 (22-27)	25 (22-29)	35 (31-39)
Smoking	12	17	15	14	19	14	14	18	16	20
Serum cholesterol	13	18	14	14	13	12	14	10	12	11
Blood pressure	8	7	12	13	12	10	9	14	14	13
Any one risk factor	33 (31-35)	42 (39-44)	41 (38-44)	41 (38-44)	45 (40-49)	36 (34-38)	37 (35-39)	41 (38-44)	42 (38-46)	43 (39-47)
Smoking+serum cholesterol	18	16	9	8	6	15	14	9	10	8
Serum cholesterol +blood pressure	14	8	11	9	6	14	13	10	9	6
Smoking+blood pressure	7	5	6	6	5	7	8	9	8	5
Any two risk factors	39 (37-42)	29 (28-31)	26 (23-28)	24 (21-26)	17 (14-20)	36 (34-38)	34 (32-35)	28 (25-30)	26 (22-30)	18 (15-22)
Smoking+serum cholesterol +blood pressure	15 (13-16)	7 (6-8)	6 (4-7)	6 (5-7)	2 (1-4)	13 (12-14)	10 (9-11)	7 (6-9)	7 (5-9)	4 (2-5)
Any two or three risk factors	54 (52-56)	36 (33-38)	32 (29-34)	30 (27-32)	19 (16-22)	50 (48-52)	43 (41-45)	35 (32-38)	33 (29-37)	22 (19-26)
Number of subjects	1717	1708	1183	1105	515	2428	2541	1180	582	581

Risk factors: (1) Smoking, (2) Serum cholesterol ≥ 6.5 mmol/l, (3) Either systolic blood pressure ≥ 160 mmHg or diastolic blood pressure ≥ 95 mmHg.

Table 9.1. Clustering of cardiovascular disease risk factors by risk factor combinations, area and year, men 30–59 years (%).

In 1972, the most common combination of two risk factors among men was smoking plus high serum cholesterol, with a prevalence of 18 % in North Karelia and 15 % in Kuopio province; by 1992 this combination was found in only 6 % and 8 %, respectively. Between 1972 and 1992 high serum cholesterol combined with hypertension decreased from 14 % to 6 % in North Karelia and from 14 % to 6 % in Kuopio. The proportion of men with all three risk factors decreased from 15 % in 1972 to 2 % ($p<0.001$) in 1992 in North Karelia, and from 13 % to 4 % ($p<0.001$) in Kuopio.

It was more common for women than men to have none of the three risk factors throughout the survey period. The rate increased from 24 % in 1972 to 57 % in 1992 ($p<0.001$) in North Karelia and from

	NORTH KARELIA					KUOPIO PROVINCE				
	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
No risk factors	24 (22-25)	43 (42-45)	43 (40-46)	48 (45-51)	57 (53-61)	28 (26-30)	39 (37-41)	44 (41-47)	50 (46-54)	56 (52-60)
Smoking	4	5	9	10	13	5	7	10	11	14
Serum cholesterol	21	26	18	17	11	23	22	17	14	10
Blood pressure	15	9	12	11	12	15	12	13	13	12
Any one risk factors	40 (38-42)	40 (36-42)	39 (36-42)	38 (35-40)	35 (32-39)	42 (40-44)	40 (38-42)	39 (36-42)	39 (35-42)	35 (31-39)
Smoking+serum cholesterol	3	3	3	3	2	3	3	2	1	3
Serum cholesterol +blood pressure	31	13	12	9	3	24	20	11	8	4
Smoking+blood pressure	1	1	2	1	2	1	1	3	1	1
Any two risk factors	35 (33-37)	16 (15-18)	17 (15-20)	14 (12-15)	7 (5-9)	28 (27-30)	19 (18-21)	16 (14-18)	11 (8-13)	8 (6-11)
Smoking+serum cholesterol +blood pressure	2 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	0 (0-1)	2 (2-3)	1 (1-2)	1 (1-2)	1 (0-2)	1 (0-2)
Any two or three risk factors	37 (34-39)	18 (16-19)	18 (16-21)	15 (13-17)	8 (6-10)	30 (28-33)	20 (19-22)	17 (17-19)	12 (10-14)	10 (7-12)
Number of subjects	1864	1795	1233	1232	599	2537	2701	982	617	617

Risk factors: (1) Smoking, (2) Serum cholesterol ≥ 6.5 mmol/l, (3) Either systolic blood pressure ≥ 160 mmHg or diastolic blood pressure ≥ 95 mmHg.

Table 9.2. Clustering of cardiovascular disease risk factors by risk factor combinations, area and year, women 30–59 years (%).

28 % to 56 % ($p<0.001$) in Kuopio (Table 9.2). Women with a combination of two or three risk factors declined from 37 % to 8 % ($p<0.001$) in North Karelia and from 30 % to 10 % ($p<0.001$) in Kuopio over the 20 year period. In women too, the favourable trend was steeper in North Karelia than Kuopio between 1972 and 1977 ($p<0.001$), after which it was similar in the two areas.

In 1972, the most common combination of any two risk factors among women was high serum cholesterol plus hypertension: 31% in North Karelia and 24 % in Kuopio. By 1992 the respective proportions with this combination had decreased to 3 % and 4 %. Smoking plus high cholesterol or hypertension, as well as the combination of all three risk factors, were uncommon in women of both areas throughout the survey period.

The proportion of subjects with two or three risk factors increased significantly with age ($p<0.001$) in both genders (Table 9.3). In every age group the proportion of high-risk individuals was greater among men ($p<0.001$); this was least so in the oldest age group (50 to 59 years) and most obvious in the youngest (30 to 39 years). In the oldest age group, the prevalence of subjects with a combination of two or three risk factors decreased among men from 60 % in 1972 to 25 % in 1992, and among women from 55 % to 16 %. In the youngest age group the proportion of high-risk individuals was 41 % among men and 13 % among women in 1972, falling to 12 % and 4 % respectively in 1992.

In men, the most common risk factor combination among the youngest age group in both 1972 and 1992 was smoking plus high se-

	MEN				WOMEN			
	30-39 YEARS		50-59 YEARS		30-39 YEARS		50-59 YEARS	
	1972	1992	1972	1992	1972	1992	1972	1992
No risk factors	20 (18-22)	47 (42-53)	9 (8-11)	25 (21-30)	46 (43-48)	67 (62-71)	8 (7-9)	40 (35-45)
Smoking	17	28	10	15	8	21	1	5
Serum cholesterol	13	6	11	16	23	5	20	18
Blood pressure	9	7	10	19	10	4	16	21
Any one risk factor	39 (37-42)	41 (36-46)	31 (28-33)	49 (44-55)	41 (39-44)	30 (25-34)	37 (35-40)	44 (39-49)
Smoking+serum cholesterol	15	6	17	7	3	3	3	3
Serum cholesterol +blood pressure	9	1	19	10	8	0	49	10
Smoking+blood pressure	7	4	8	5	1	1	1	1
Any two risk factors	32 (30-34)	11 (7-14)	43 (41-46)	22 (17-26)	13 (11-14)	4 (2-6)	52 (50-55)	14 (11-18)
Smoking+serum cholesterol +blood pressure	9 (7-10)	1 (0-2)	17 (15-19)	4 (2-6)	1 (0-1)	0	3 (2-4)	2 (1-3)
Any two or three risk factors	41 (38-43)	12 (8-15)	60 (57-63)	25 (21-30)	13 (11-15)	4 (2-6)	55 (52-58)	16 (12-20)
Number of subjects	1377	330	1177	354	1374	407	1418	377

Risk factors: (1) Smoking, (2) Serum cholesterol $\geq$ 6.5 mmol/l, (3) Either systolic blood pressure $\geq$ 160 mmHg or diastolic blood pressure $\geq$ 95 mmHg.

Table 9.3. Clustering of cardiovascular disease risk factors by risk factor combinations, age group, gender and year (%).

rum cholesterol, and among the oldest age group was high serum cholesterol plus high blood pressure. The commonest risk factor combination in both age groups of women in 1972 was high serum cholesterol plus high blood pressure. However, the proportion with this combination decreased considerably in both age groups, from 8 % to 0 % and from 49 % to 10 %, respectively, between 1972 and 1992. As with men, smoking plus high serum cholesterol was the most common risk factor combination in women aged 30 to 39 in 1992.

Partial age-adjusted correlations of serum cholesterol with systolic and diastolic blood pressure were positive among men in 1972, 1982 and 1992 (Table 9.4). Smoking correlated positively with serum cholesterol and inversely with diastolic blood pressure in 1972 and 1992, though due to limited power the correlation in 1992 was not significant.

Among women serum cholesterol correlated positively with systolic and diastolic blood pressure, but the correlation weakened from 1972 to 1992. In 1972, smoking correlated inversely with systolic and diastolic blood pressure but had no correlation with serum cholesterol. By 1992 the inverse correlation between smoking and blood pressure had

	MEN					
	SERUM CHOLESTEROL			SMOKING		
	1972	1982	1992	1972	1982	1992
Systolic blood pressure	0.11 (***)	0.09 (***)	0.13 (***)	–0.02	0.02	0.02
Diastolic blood pressure	0.13 (***)	0.12 (***)	0.16 (***)	–0.07(***)	–0.03	–0.07(*)
Serum cholesterol				0.08 (***)	0.06 (**)	0.06
	WOMEN					
	SERUM CHOLESTEROL			**SMOKING**		
	1972	1982	1992	1972	1982	1992
Systolic blood pressure	0.11(***)	0.10 (***)	0.06 (*)	–0.07(***)	–0.03	–0.03
Diastolic blood pressure	0.11(***)	0.13 (***)	0.06 (*)	–0.07(***)	–0.02	0.00
Serum cholesterol				–0.00	–0.04	0.12 (***)

* $p<0.05$
** $p<0.01$
*** $p<0.001$

Table 9.4. Age adjusted partial correlations between systolic and diastolic blood pressure, serum cholesterol and the amount of daily smoking in 1972, 1982 and 1992, men and women 30 to 59 years.

disappeared and there was positive correlation between smoking and serum cholesterol.

Analysis of covariance of mean systolic blood pressure by smoking status and serum cholesterol level among men showed a significant and fairly similar reduction of blood pressure in all categories of other risk factors between 1972 and 1992. In both years blood pressure was higher among those with high compared to low serum cholesterol, but this did not depend on smoking status (Table 9.5). The mean amount of daily smoking decreased significantly between 1972 and 1992 in all categories of systolic blood pressure and serum cholesterol, but the decrease was smaller among men with high blood pressure plus high serum cholesterol than in other groups (Table 9.6). The mean serum cholesterol was slightly but significantly higher among smokers and men with elevated blood pressure, compared to non-smokers and to normotensive men (Table 9.7). From 1972 to 1992, there was a universal fall in serum cholesterol levels regardless of smoking status and blood pressure level.

	SMOKING			
	NO		YES	
	CHOLESTEROL		CHOLESTEROL	
YEAR	LOW[a]	HIGH[b]	LOW	HIGH
1972	145.5	149.5	144.2	148.0
	(975)	(1082)	(839)	(1250)
1982	144.0	147.7	145.6	146.8
	(912)	(527)	(554)	(370)
1992	139.8	142.5	138.5	143.8
	(522)	(192)	(271)	(111)
Net reduction	5.7	7.0	4.0	4.2
1972-1992	(3.9%)	(4.7 %)	(4.0 %)	(2.8%)

Main effects: Smoking n.s.
Serum cholesterol <0.001
Year <0.001

2-way interactions: n.s.
3-way interactions: n.s.

[a] Serum cholesterol < 6.5 mmol/l
[b] Serum cholesterol ≥ 6.5 mmol/l

Table 9.5. Mean systolic pressure by smoking status and serum cholesterol level in 1972, 1982 and 1992, men 30 to 59 years, adjusted for age.

	BLOOD PRESSURE			
	LOW[a]		HIGH[b]	
	CHOLESTEROL		CHOLESTEROL	
YEAR	LOW[c]	HIGH[d]	LOW	HIGH
1972	8.4	10.5	7.8	8.9
	(1147)	(1205)	(680)	(1145)
1982	6.8	8.4	7.0	7.3
	(1013)	(501)	(481)	(406)
1992	6.2	7.1	5.5	7.7
	(611)	(206)	(185)	(97)
Net reduction	2.2	3.4	2.3	1.2
1972-1992	(26.2%)	(32.4 %)	(29.5 %)	(13.5%)

Main effects: Serum cholesterol < 0.001
Blood pressure n.s.
Year <0.001
2-way interactions: n.s.
3-way interactions: n.s.

[a] Both systolic blood pressure < 160 mmHg and diastolic blood pressure < 95 mmHg
[b] Either systolic blood pressure ≥ 160 mmHg or diastolic blood pressure ≥ 95 mmHg
[c] Serum cholesterol < 6.5 mmol/l
[d] Serum cholesterol ≥ 6.5 mmol/l

Table 9.6. Mean amount of daily smoking by blood pressure and serum cholesterol level in 1972, 1982 an 1992, men 30 to 59 years, adjusted for age.

	BLOOD PRESSURE			
	LOW[a]		HIGH[b]	
	SMOKING		SMOKING	
YEAR	NO	YES	NO	YES
1972	6.5	6.8	6.9	7.0
	(1114)	(1222)	(943)	(866)
1982	6.1	6.3	6.4	6.5
	(887)	(601)	(552)	(323)
1992	5.8	5.9	6.0	6.2
	(519)	(295)	(195)	(87)
Net reduction	0.7	0.9	0.8	0.8
1972-1992	(10.8%)	(13.2 %)	(13.0 %)	(11.4%)

Main effects: Smoking < 0.001
Blood pressure <0.001
Year <0.001
2-way interactions: n.s.
3-way interactions: n.s.

[a] Both systolic blood pressure < 160 mmHg and diastolic blood pressure < 95 mmHg
[b] Either systolic blood pressure ≥ 160 mmHg or diastolic blood pressure ≥ 95 mmHg

Table 9.7. Mean serum cholesterol by smoking status and blood pressure level in 1972, 1982 and 1992, men 30 to 59 years, adjusted for age.

4. DISCUSSION

The importance of smoking, blood pressure and serum cholesterol as risk factors varies among the populations of different countries. The Seven Countries Study found that men who smoke, have elevated blood pressure or increased serum cholesterol, are at greater excess risk of coronary heart disease or death in Finland, The Netherlands and U.S.A., compared to Southern Europe and Japan (Keys et al. 1980).

The impact of the three major cardiovascular disease risk factors on morbidity and mortality among the North Karelia Project baseline survey sample population in eastern Finland was studied in 1981 (Salonen et al. 1981). The results indicated that smoking, elevated blood pressure and serum cholesterol are both independently and jointly related to an increased risk of myocardial infarction and death due to all causes and to CVD, and that this phenomenon could largely explain the high myocardial infarction rates in the area.

The strength of the observed inter-relationships between the risk factors and the risk, as well as the population-attributable risk, is largely dependent on the cut-off point used for a continuous risk factor such as blood pressure or serum cholesterol. When the cut-off point is raised the number of disease events in the high-risk category – and the population attributable risk – become smaller, but the risk ratio rises. In the present survey the cut-off points for blood pressure (160/95 mm Hg) and serum cholesterol (6.5 mmol/l) were chosen mainly on the basis of national and international recommendations for the treatment of hypertension and hypercholesterolaemia. It can be argued that a serum cholesterol value of 6.5 mmol/l is still rather high, and if we had chosen a lower cut-off point the proportion of high-risk individuals would have risen considerably. In 1992, only about 20 % of adult men and 32 % of women in Finland had a serum total cholesterol level lower than 5.0 mmol/l (Vartiainen et al. 1994), while back in 1972 the proportion was below 10 % in both genders.

Due to a continuous decrease in single risk factors among the population of eastern Finland (Vartiainen et al. 1994), the proportion of individuals with a combination of two or three risk factors also fell markedly from 1972 to 1992. The favourable trend was stronger in North Karelia than in Kuopio during the first five years between 1972 and

1977, but since then has been quite similar in the two areas. This finding is consistent with the fact that the intensive community-based cardiovascular disease prevention programme began in North Karelia in 1972, and that many of the activities subsequently spread to the neighbouring province of Kuopio, and then to other parts of Finland (Nissinen et al. 1988). In both areas the reduction of risk factor levels in the 1970s was rapid; it then levelled off between 1982 and 1987, and progressed again from 1987 to 1992.

The proportion of individuals with two or three risk factors was higher among men than women, particularly in the youngest age group. The contrast between the genders in their exposure to these high risk factor levels earlier in life may partly explain the gender difference in CVD morbidity and mortality in Finland, which is larger than in most other countries (WHO Monica Project 1987).

About one third of men with high blood pressure or high serum cholesterol, or both, were still smokers in 1992. The decrease in smoking was less among hypertensive men with high serum cholesterol than other men. Although smoking in women was rarely combined with other risk factors, mainly because older women rarely smoked, correlations between smoking and other risk factors strengthened from 1972 to 1992. This may mean that smoking, which in 1972 was common among all men but in women was mostly confined to the young and fairly educated, is now tending to become a habit among those with low education and socioeconomic status. The true clustering of risk factors may have been even stronger than we observed in our study, because it is often the case that persons with the most unfavourable health behaviour and highest risk factor levels fail to participate in such surveys (Crique et al. 1978). The correlation between blood pressure and serum cholesterol was positive in both genders in both 1972 and 1987. This suggests common factors (obesity, high fat intake) in the development of high blood pressure and serum cholesterol (Tuomilehto et al. 1985).

The observed decrease in CVD risk factor clustering in eastern Finland demonstrates that this population-based strategy for controlling cardiovascular diseases has also been effective for lowering risk factors among subjects with the highest risks. In the future, the socioeconomic background of risk factor clustering needs closer study. It is possible that high-risk behaviours such as smoking and heavy consumption of saturated fat

and salt were normal among the population in 1972, but in 1992 were somewhat extreme behaviours which thus clustered in a particular population group. Because the clustering of risk factors is mainly explained by behavioural factors, further research is needed on health education methods in different target groups in order to improve the effectiveness of preventive strategies, particularly among the sub-populations at highest risk.

In summary, the proportion of men with none of the three risk factors rose from 13 % to 36 % in North Karelia and from 15 % to 35 % in Kuopio between 1972 and 1992. Among women the respective increases were from 24 % to 57 % and from 28 % to 56 %. The proportion of high risk men with a combination of two or three risk factors decreased from 54 % to 19 % in North Karelia and from 50 % to 22 % in Kuopio; among women the decreases were from 37 % to 8 % and from 30 % to 10 %, respectively. In both genders the latter trend was stronger in North Karelia during the first five years of follow-up, but was subsequently quite similar in the two areas. The observed decrease in CVD risk factor clustering demonstrates that this population-based strategy for the control of CVD has also been effective in decreasing the risk factor levels among high risk subjects.

REFERENCES

Crique MH, Barret-Connor E, Austin M. Differences between respondents and non-respondents in a population based cardiovascular disease study. Am J Epidemiol 1978;108:367–372.

Kannel WB, Dawber TR, Kagan A, et al. Factors of risk in the development of coronary heart disease-six year follow-up experience: The Framingham Study. Ann Intern Med 1961;55:33–50.

Keys A. Coronary heart disease in seven countries. Am Heart Assoc Monograph 1970; 29.

Keys A, Aravanis C, Blackburn H, et al. Seven Countries. A multivariate analysis of death and coronary heart disease. Cambridge: Harvard University Press, 1980.

Nissinen A, Tuomilehto J, Puska P. From pilot project to national implementation. Experiences from the North Karelia Project. Scand J Prim Health Care 1988;Suppl 1:49–56.

Puska P, Tuomilehto J, Salonen J, et al. Community control of cardiovascular disease-The North Karelia Project: Evaluation of a comprehensive community programme for control of cardiovascular diseases in 1972–1977 in North Karelia. Copenhagen: WHO/EURO, 1981.

Salonen JT, Puska P, Kottke TE. Smoking, blood pressure and serum cholesterol as risk factors of acute myocardial infarction and death among men in Eastern Finland. Eur Heart J 1981;2:365–373.

Stamler J. Lifestyles, major risk factors, proof and public policy. Circulation 1978;1:3–19.

The Pooling Project Research Group: Relationship of blood pressure, serum cholesterol, smoking habit, relative weight and ECG abnormalities to incidence of major coronary events: final report of the Pooling Project. Dallas. Am Hearth Assoc Monograph 1978;60.

Tuomilehto J, Pietinen P, Salonen JT, et al. Nutrition-related determinants of blood pressure. Prev Med 1985;14:413–427.

Vartiainen E, Puska P, Jousilahti, Korhonen HJ, Tuomilehto J, Nissinen A. Twenty year trends in coronary risk factors in North Karelia and in other areas in Finland. (In press Int J Epidemiol).

WHO Monica Project. Geographic variation in mortality from cardiovascular diseases. WHO Stat Q 1987;40:171–184.

10. DIFFERENCES BETWEEN EDUCATIONAL GROUPS IN RISK FACTOR TRENDS

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1. INTRODUCTION

Although overall changes in coronary heart disease (CHD) mortality in Finland have been favourable since the late 1960s (Pyörälä et al. 1985), the disparity in CHD mortality between socioeconomic groups has since widened (Valkonen et al. 1990, Valkonen et al. 1993, Valkonen 1992). There is evidence of similar developments in England (Marmot and McDowell 1986) and in the United States (Wing et al. 1987, Pappas et al. 1993) during the 1970s.

In Finland (Valkonen et al. 1993, Tuomilehto et al. 1987, Pekkanen et al. 1995a, Valkonen 1992, Pekkanen et al. 1995b) as in most other industrialized countries (Adler et al. 1993), the lower socioeconomic groups tend to have a worse coronary risk profile and higher coronary mortality than the better off. Socioeconomic differences in CHD mortality are more pronounced in Finland than elsewhere in Scandinavia, resembling more those seen in England (Pyörälä et al. 1985, Valkonen 1992). Part of the excess mortality is due to the more adverse risk factor profile (Pekkanen et al. 1995a, Salonen 1982, Marmot et al. 1984), which suggests an approach for narrowing socioeconomic disparities in health according to health policy goals (WHO 1985). However, observations from industrialized countries seem to be suggesting growing socioeconomic disparities in the prevalence of cardiovascular risk factors, especially smoking (Pierce et al. 1989, Covey et al. 1992, Rosen et al. 1990, National Center for Health Statistics 1987). Moreover, it is possible that health education campaigns have a bigger impact on better educated population groups, which might result in further education-based differences in risk factor levels.

This chapter examines the changes which have occurred in differences between educational groups in CHD risk factors among middle-aged men and women in Eastern Finland, and compares North Karelia with its reference province of Kuopio.

2. STUDY POPULATION AND METHODS

The cross-sectional population surveys in 1972, 1977, 1982, 1987 and 1992 assessed the levels of coronary risk factors in North Karelia and Kuopio, as described in the previous chapter.

In the surveys, the question on years of education was always: "How many years of your life did you spend at school, or in full-time study altogether?" The average length of education in Finland has increased significantly over the past 20 years, so to obtain groups which would remain more or less the same size throughout the study period, each 5-year birth cohort, men and women included, was divided into four educational categories.

In the study population, birth years ranged from 1913 to 1962, so there were ten 5-year birth cohorts. For each cohort, the mode for years of education was determined. From oldest cohort to youngest the modes were: 4, 4, 6, 6, 8, 8, 8, 8, 10, and 11 years. Persons with as many years of education as the mode formed what we called the "medium" education category. Those with less education than this belonged to the "low" education group, while those in the highest quantile of all formed the "highest" education group. The remaining subjects were termed the "higher" education group.

Differences between educational groups in risk factors were analyzed using logistic regression models for categorical variables, and analysis of covariance for continuous variables. No trend tests were used; education was always treated as a categorical variable with three degrees of freedom. All the models included year of survey and age. Differences between educational groups in risk factor trends were tested by adding to the model an interaction term between education and year of survey. (df=9).

3. RESULTS

The average time spent at school and studying lengthened rapidly after 1972, the year of the first surveys in eastern Finland. Taking North Karelia and Kuopio together, the proportion of men with under 8 years of education was 55 % in 1972, but 15 % in 1992; at the same time, men with at least 12 years of education increased from 9 % in 1972 to 31 % in 1992. The respective percentages for women with the shortest and longest education were 51 % and 9 % in 1972, and 9 % and 38 % in 1992. The numbers of subjects surveyed by level of education (using categories described earlier) are given in Table 10.1.

Most risk factors were lower among the most educated men and women throughout the study period (Fig 10.1–10.3). The main excep-

LEVEL OF EDUCATION*	YEAR 1972		1977		1982		1987		1992	
	n	%	n	%	n	%	n	%	n	%
MEN, NORTH KARELIA										
LOW	375	21	369	21	276	23	260	23	128	25
MEDIUM	592	33	636	36	437	37	326	29	131	25
HIGHER	572	32	499	28	307	26	351	31	165	32
HIGHEST	261	15	259	15	171	14	192	17	95	18
MEN, KUOPIO										
LOW	478	18	468	18	237	20	132	22	119	20
MEDIUM	915	35	908	35	390	33	193	32	145	25
HIGHER	748	29	739	29	332	28	163	27	190	33
HIGHEST	465	18	477	18	216	18	114	19	128	22
WOMEN, NORTH KARELIA										
LOW	328	17	311	17	180	15	220	18	84	14
MEDIUM	578	30	571	31	338	28	302	25	142	23
HIGHER	699	36	648	36	450	37	457	37	245	40
HIGHEST	334	17	294	16	254	21	247	20	139	23
WOMEN, KUOPIO										
LOW	357	13	351	13	140	14	103	17	105	17
MEDIUM	874	32	797	29	279	29	137	22	127	20
HIGHER	895	33	1011	37	330	34	236	39	254	41
HIGHEST	594	22	569	21	217	22	137	22	136	22

* Number of years of education relative to each person's five year birth cohort.

Table 10.1. Numbers of men and women aged 30-59 years examined by level of education in North Karelia and Kuopio.

tion was smoking among women during the 1970s. Education differences in serum cholesterol and diastolic blood pressure level did not change significantly from 1972 to 1992 in either study area.

In 1972, the best educated women had the highest prevalence of smoking (Fig. 10.3). Since then smoking has declined somewhat in this group but increased in all others, so that the association between education and smoking has changed direction in both study areas (interaction between year of survey examination and educational level $p<0.01$). The rise in smoking among women has been especially rapid among the least educated.

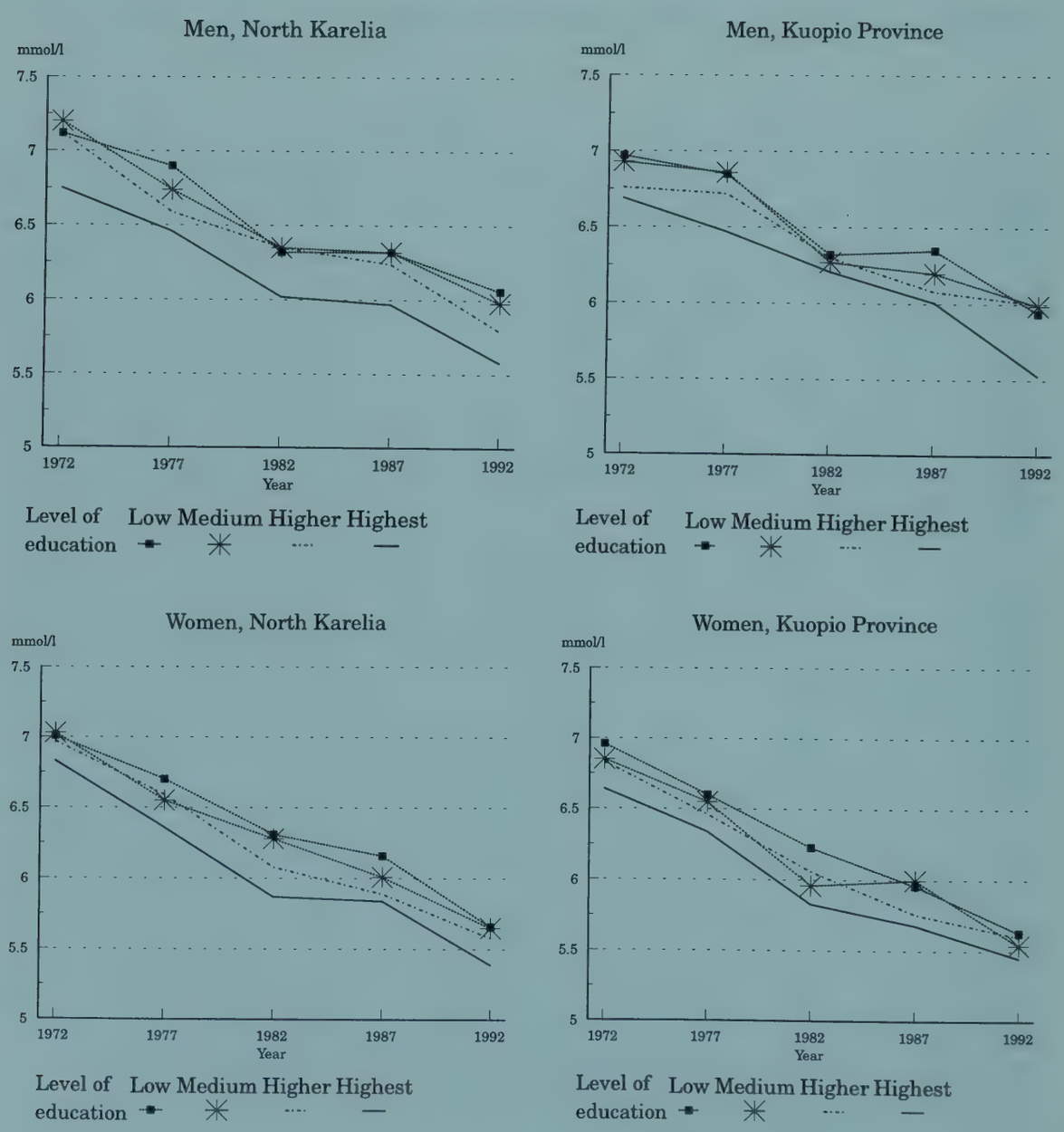

Figure 10.1. Serum Cholesterol

4. DISCUSSION

These findings reveal no major contrasts between North Karelia and Kuopio in terms of differences between educational groups in mean cardiovascular risk factor levels. The declines in serum cholesterol and diastolic blood pressure among both sexes, and in smoking among men, have been very similar in all educational groups, causing very little increase or decrease in the education differences in risk factor levels. By contrast, differences between educational groups in smoking among women have widened rapidly.

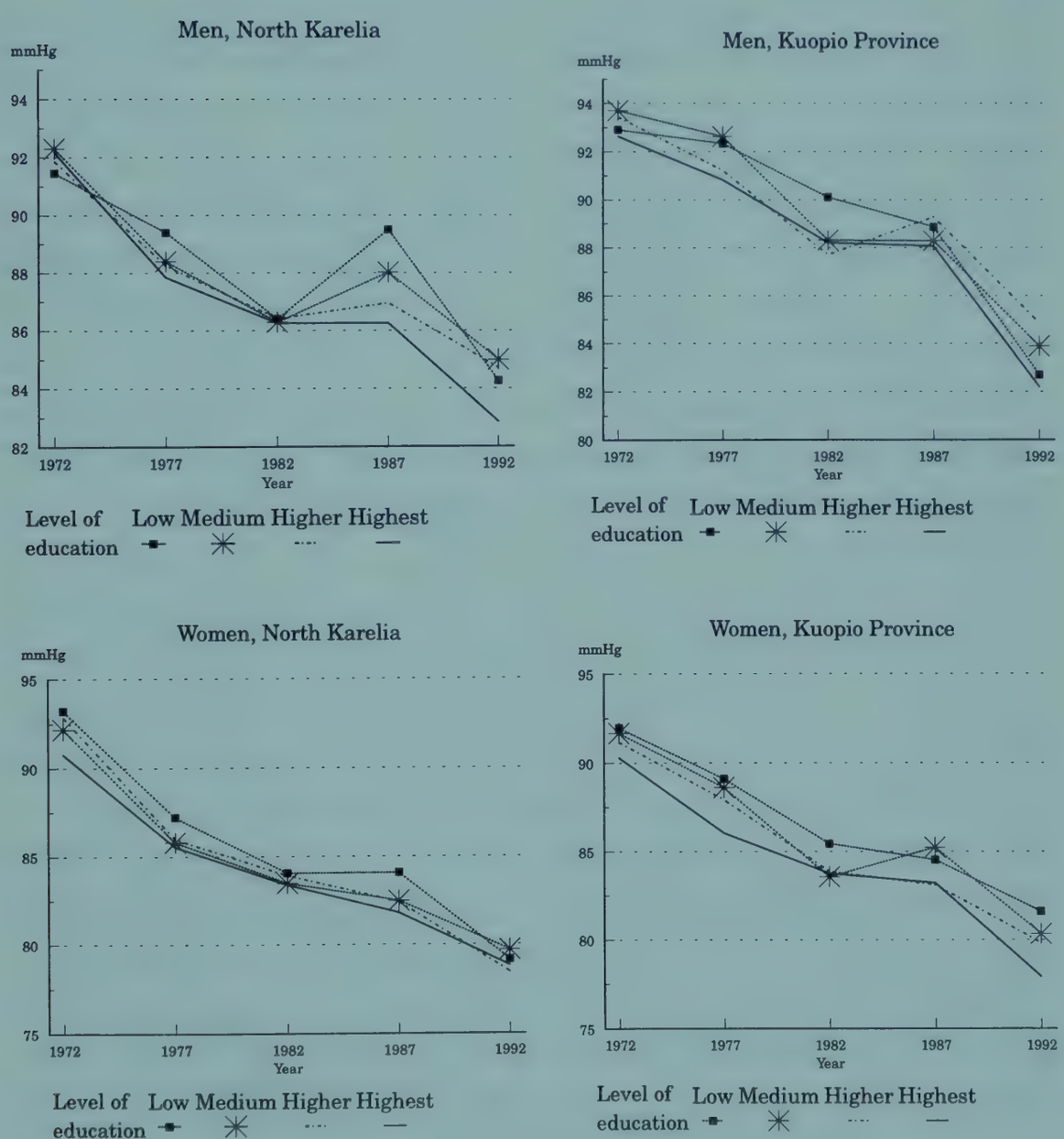

Figure 10.2. Diastolic blood pressure

Finland has enjoyed a remarkable fall in coronary heart disease mortality over the last 20 years. Nevertheless, male CHD mortality, especially in Eastern Finland, remains among the highest in the world (WHO MONICA project 1987). Average levels of many classical CHD risk factors also seem to have declined since the mid-60s (Pyörälä et al. 1985, Vartiainen et al. 1994, Pekkanen 1987). Although changes have generally been favourable, relative disparities in CHD mortality between educational groups have increased. Absolute differences, on the other hand, have been fairly stable. The findings are similar when occupation rather than education is used in the analyses (Valkonen et al. 1990, Valko-

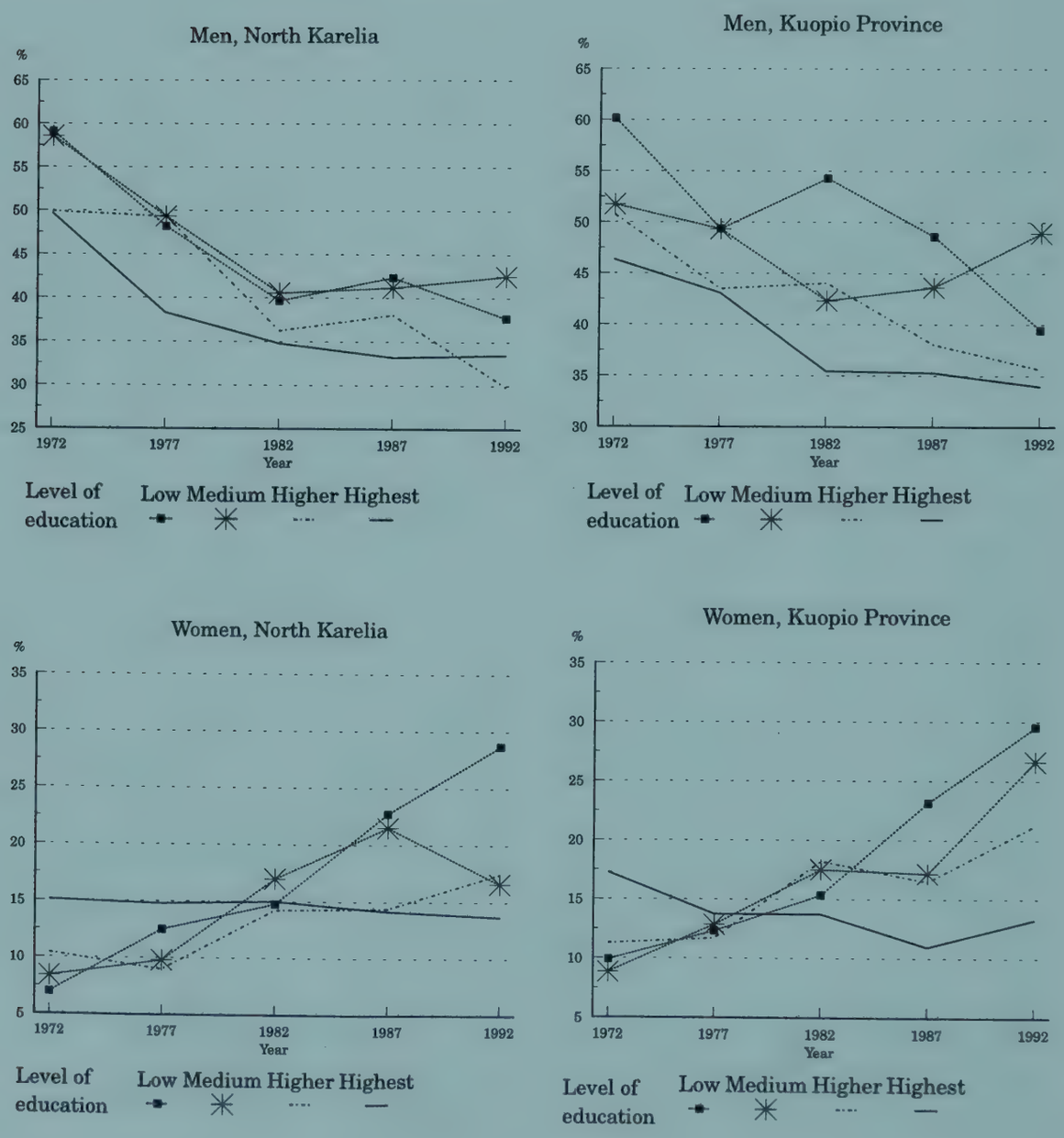

Figure 10.3. Smokers

nen et al. 1993). There is evidence of corresponding developments in England during the 1970s (Marmot and McDowell 1986), and in the United States education differences in all-cause mortality seem to have widened between 1960 and 1986 (Pappas et al. 1993). Variations in CHD mortality between communities with differing occupational structures also grew in the USA between 1968 and 1982 (Wing et al. 1987).

In most industrialized countries the lower socioeconomic groups tend to have a more adverse cardiovascular risk factor profile (Tuomilehto et al. 1978, Adler et al. 1993, Pekkanen et al. 1995b). Much of the association between socioeconomic status and CHD mortality in Finland, as elsewhere, is mediated through the known, preventable risk factors (Pekkanen et al. 1995a, Salonen 1982, Marmot et al. 1984). There are a few reports suggesting growing socioeconomic differences in the prevalence of some cardiovascular risk factors. Two reports from the United States (Pierce et al. 1989, Covey et al. 1992) and one from Sweden (Rosen et al. 1990) have exposed increasing socioeconomic disparities in the prevalence of smoking, and a study from the United States suggests the same trend for mean serum cholesterol level (National Center for Health Statistics 1987).

The present analyses reveal growing differences between educational groups in the prevalence of smoking among women. It is not possible to make a direct comparison between the present risk factor trends and the general mortality trends in Finland, as these data concern eastern Finland only. If the respective changes on the national scale have been similar to those found here, the diverging trends in smoking among women may well have contributed to the similar divergence in CHD mortality among them. However, smoking has increased mainly in the younger age groups (Vartiainen et al. 1986), and may not yet have had a strong effect on mortality. Also, there were no concomitant increases in differences between educational groups in serum cholesterol, diastolic blood pressure, and in smoking among men. So the observed rising trend in certain risk factor levels would appear too limited to explain the widening socioeconomic contrast in CHD mortality, at least among men. The increasing differences between educational groups in CHD mortality may partly reflect similar tendencies in other factors, eg. physical activity, use of alcohol, and dietary changes not reflected in serum cholesterol level. The use of health services may also vary between socioe-

conomic classes, which could lead to differences in prognosis of acute myocardial infarction.

There was no evidence here of diminishing differences in risk factor levels between educational groups. However, the present analyses do not suggest that a community-wide cardiovascular prevention programme would actually increase differences between educational groups in risk factor levels, as has been suggested. In order to narrow health inequalities between socioeconomic groups in the future, health promotion measures and methods should take into particular account the needs of the lower social classes. Emerging health inequalities also need to be addressed at multiple levels, from general social policy to everyday practice, in order to create wider and more effective programmes of health promotion (Adler et al. 1993).

In summary, the better educated men and women of both study areas tended to have the lowest levels of serum cholesterol and diastolic blood pressure throught the entire study period from 1972 to 1992. The decline in these risk factors occurred at about the same rate in all the educational groups in both provinces. The same was true of smoking among men, while the proportion of women smokers was highest among the more educated in the 1970s but lowest in the 1980s, again in both study areas. The overall findings indicate no major disparities of the intervention effect in North Karelia between people with different levels of education.

REFERENCES

Adler NE, Boyce WT, Chesney MA, Folkman S, Syme SL. Socioeconomic inequalities in health. No easy solution. JAMA 1993;269:3140–3145.

Covey LS, Zang EA, Wynder EL. Cigarette smoking and occupational status: 1977 to 1990. Am J Public Health 1992;82:1230–1234.

Marmot MG, McDowell ME. Mortality decline and widening social inequalities. Lancet 1986;2:274–276.

Marmot MG, Shipley MJ, Rose G. Inequalities in death-specific explanations of a general pattern? Lancet 1984;1:1003–1006.

National Center for Health Statistics. Trends in serum cholesterol levels among US adults aged 20 to 74 years. JAMA 1987;257:937–942.

Pappas G, Queen S, Hadden W, Fisher G. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. New Engl J Med 1993;329:103–109.

Pekkanen J. Coronary heart disease during a 25-year follow-up. Risk factors and their secular trends in the Finnish cohorts of the Seven Countries study. Academic dissertation. Health Services Research by the National Board of Health in Finland no. 45. Government Printing Centre, Helsinki 1987. MD Thesis.

Pekkanen J, Tuomilehto J, Uutela A, Vartiainen E, Nissinen A. Social class, health behaviour, and mortality among men and women in Eastern Finland. Br Med J 1995;311:589–593.

Pekkanen J, Uutela A, Valkonen T, et al. Coronary risk factor levels: Differences between educational groups in 1972–1987 in Eastern Finland. J Epidemiol Comm Health, 1996;49:144–149.

Pierce JT, Fiore MC, Novotny TE, Hatziandreu EJ, Davis RM. Trends in cigarette smoking in the United States. JAMA 1989;261:56–60.

Pyörälä K, Salonen JT, Valkonen T. Trends in coronary heart disease mortality and morbidity and related factors in Finland. Cardiology 1985:72:35–51.

Rosen M, Hanning M, Wall S. Changing smoking habits in Sweden: Towards better health, but not for all. Int J Epidemiol 1990;19:316–322.

Salonen JT. Socioeconomic status and risk of cancer, cerebral stroke, and death due to coronary heart disease and any disease: A longitudinal study in Eastern Finland. Journal of Epidemiology and Community Health 1982;36:294–297.

Tuomilehto J, Puska P, Virtamo J, Neittaanmäki L, Koskela K. Coronary risk factors and socioeconomic status in Eastern Finland. Prev Med 1978;7:539–549.

Valkonen T, Martelin T, Rimpelä A. Socio-economic mortality differences in Finland 1971–85. Central Statistical Office of Finland, Studies 176, Helsinki 1990.

Valkonen T. Trends in regional and socio-economic mortality differentials in Finland. Int J Health Sciences 1992;3:157–166.

Valkonen T, Martelin T, Rimpelä A, Notkola V, Savela S. Socio-economic mortality differences in Finland 1981–90. Statistics Finland, Population 1, Helsinki 1993.

Vartiainen E, Puska P, Koskela K, Nissinen A, Tuomilehto J. Ten-year results of a community-based anti-smoking program (as part of the North Karelia Project in Finland). Health Educ Res 1986;1:175–184.

Vartiainen E, Puska P, Jousilahti P, et al. Twenty-year trends in coronary risk factors in North Karelia and in other parts of Finland. Int J Epidemiol 1994;23:495–504.

Wing S, Dargent-Molina P, Casper M, Riggan W, Hayes CG, Tyroler HA. Changing association between community occupational structure and ischaemic heart disease mortality in the United States. Lancet 1987;2:1067–1070.

WHO MONICA project (prepared by Tuomilehto J, Kuulasmaa K, Torppa J). Geographic variation in mortality from cardiovascular diseases. Baseline data on selected population characteristics and cardiovascular mortality. World Health Statistics Quarterly 1987;40:171–184.

World Health Organization. Regional Office for Europe. Targets for health for all. Copenhagen 1985.

11. HEALTH BEHAVIOUR CHANGES IN NORTH KARELIA

Satu Helakorpi
and Pekka Puska

1. INTRODUCTION

Trends in health behaviour in North Karelia from 1972 to 1977 were monitored by the biannual postal surveys designed to gather information for on-going project planning, feed-back and evaluation. The methods and some of the results of these surveys were reported in the WHO Monograph on the North Karelia Project in 1972–77 (Puska et al. 1981).

Since 1978, the National Public Health Institute has monitored the health behaviour of the adult Finnish population by annual postal surveys, with a supplementary sample of North Karelians included. This extra sample has been a useful tool in the intervention, management and evaluation of the North Karelia Project. The survey focuses mainly on smoking and dietary habits, but also covers alcohol consumption, dental hygiene, physical exercise, subjective health status and use of health services.

This chapter reviews the change process in health behaviour among the adult population of North Karelia in 1972–1993. Only limited information is available for the period 1972–77, so the results for 1978–93 are more detailed. The health behaviour variables concern current smoking, dietary habits, time of last blood pressure measurement, time of last blood cholesterol test, physical exercise and consumption of alcohol.

2. METHODS

The baseline project survey took place in spring 1972. From 1972 to 1977 the data was gathered biannually with postal questionnaires using independent random samples of 25 to 59-year-old citizens of North Karelia. The average response rate was 87 %.

Since 1978 the study material has been obtained annually via a postal survey. Independent random samples of the adult Finnish population aged 15 to 64 are drawn from the National Population Register. The sample size is 5000 for the national sample and 1200 in North Karelia. A questionnaire is mailed in April and another one to the non-respondents after about one month. A final questionnaire is mailed in June to those who have still not responded. The average response rate is 78 % in North Karelia.

In this report respondents younger than 25 years or older than 59 years were excluded to preserve comparability between all the surveys done in North Karelia from 1972 to 1993 (Table 11.1).

3. RESULTS

3.1 Smoking

The proportion of current smokers (regular smokers for at least one year and had smoked during the previous month) was 51 % among men in spring 1972 (baseline survey) and thereafter declined until 1980, since when it has varied between 35 % and 40 %. In 1992–93 the prevalence of smoking among 25–59-year-old men was 37 % in North Karelia and 38 % in the national sample.

YEAR OR YEAR GROUP	MEN	WOMEN	TOTAL
SPRING 1972	2234	2292	4526
AUTUMN 1972	1182	1118	2300
1973	2043	2128	4171
1974	2303	2227	4530
1975	2322	2310	4632
1976	2295	2191	4486
1978-79	740	630	1370
1980-81	793	633	1426
1983	391	323	714
1984-85	692	614	1306
1986-87	736	685	1421
1988-89	640	643	1283
1990-91	631	659	1290
1992-93	601	613	1214

Table 11.1. Number of respondents by year and sex (aged 25–59 years).

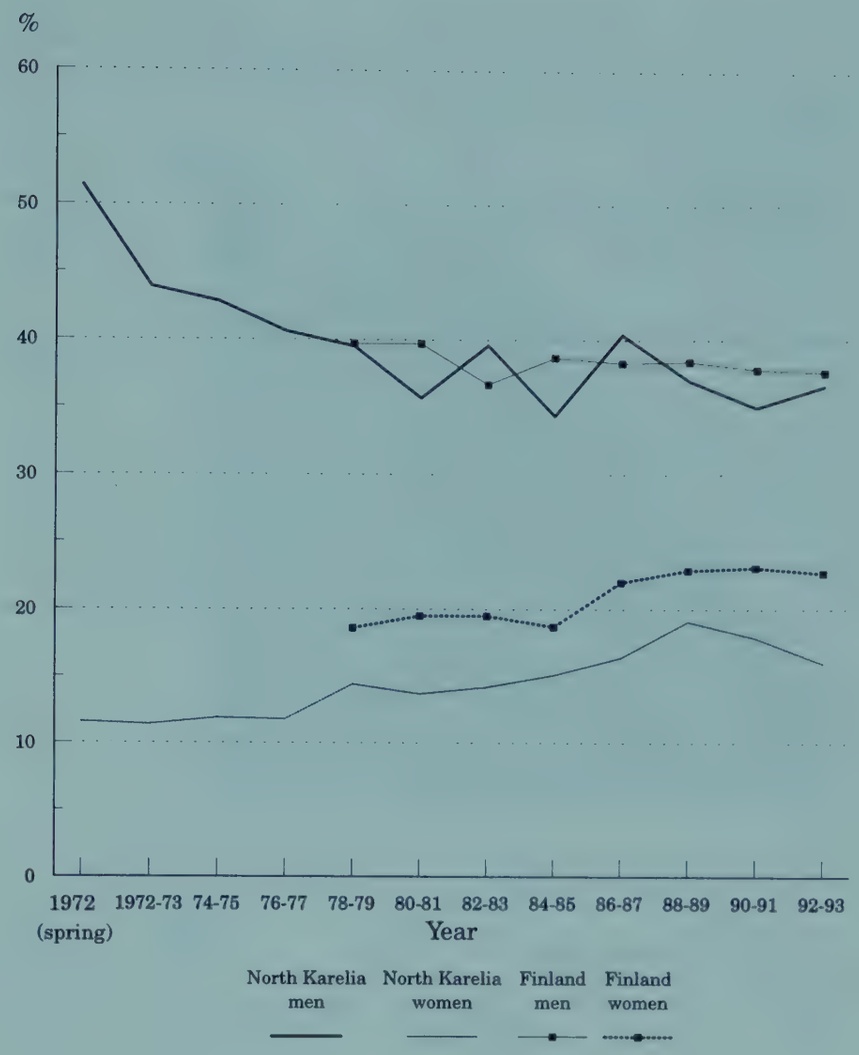

Figure 11.1. Proportion (%) of current smokers among 25–59 year old people in North Karelia and in Finland by gender in 1972–93.

Among North Karelian women the proportion of current smokers was about 12 per cent in the 1970s. From 1980 to 1987 the prevalence was below 16 %, but had risen to 19 % by the end of the 1980s. In 1992–93 the rate was again lower, at 16 %. Smoking among women has been lower in North Karelia than on the national level throughout the entire period of follow-up surveys (Figure 11.1).

Among the smokers surveyed from 1972 to 1993 almost 75 % of men and 70 % of women were of the opinion that they smoked too much. Between 1978 and 1993 almost 60 per cent of both sexes claimed they wanted to quit smoking, and about one-third of current smokers reported that a doctor or nurse had advised them to quit. Among smoking men in 1972–79, nearly one fifth reported having tried to quit during the previous six months. The corresponding prevalence among women averaged 35 %. Since 1980 about 10 % of men and 20 % of women have tried to quit during the previous six months (Figure 11.2).

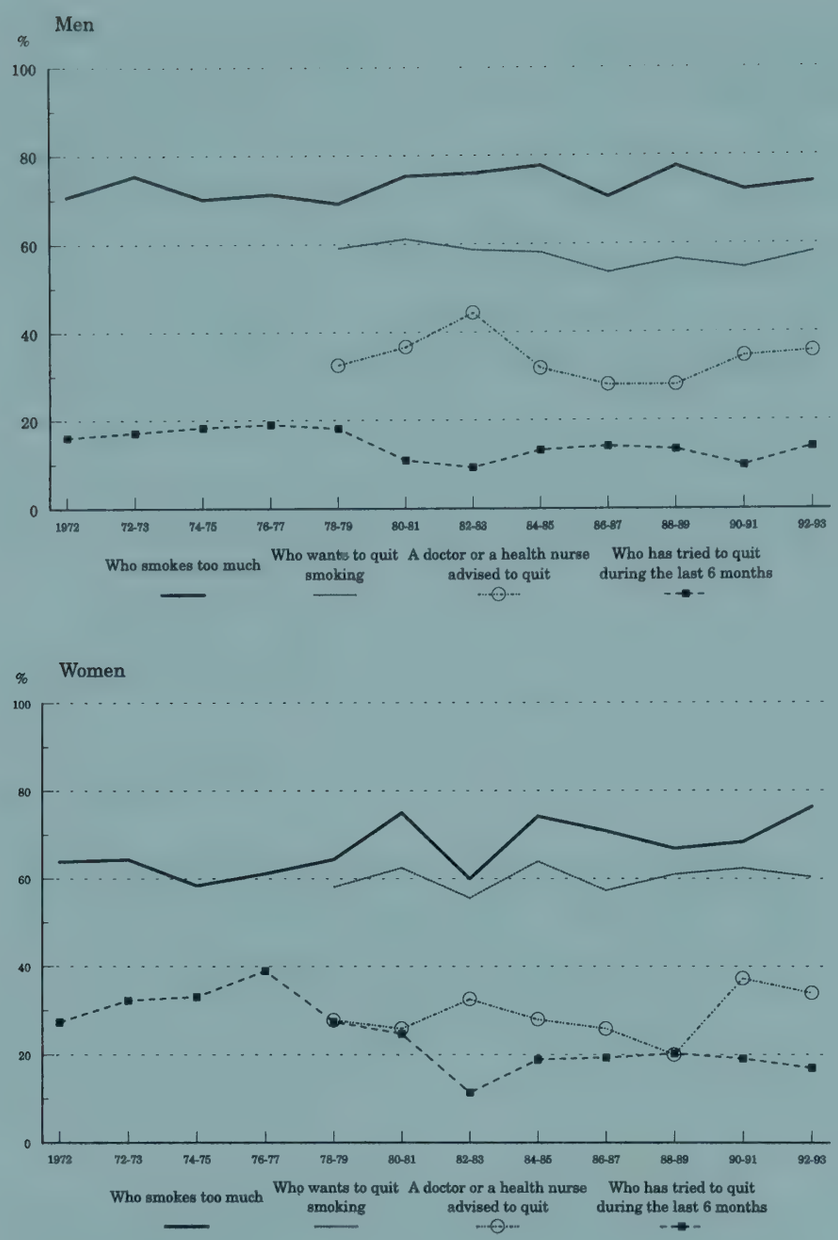

Figure 11.2. Proportion (%) of current smokers, by gender, assessing that they smoked too much, wanted to quit, had tried to quit in the past six months, and had been advised to quit. North Karelia, 1972–93.

3.2 Dietary habits

Dietary habits have made extraordinary progress in the direction of recommendations. Over the study period the consumptions of butter and high fat milk have been in dramatic decline. At home, the use of vegetable oil for cooking and the consumption of fresh vegetables rose substantially from 1972 to 1993.

In the spring of 1972 in North Karelia, 86 % of men and 82 % of women reportedly used mainly butter on bread; by 1993 the proportions were just 12 % and 10 %, respectively, while 35 % and 41 % were using low fat spread (margarine with 40 or 60 % fat content) on bread (Figures 11.3 and 11.4). On the national level in 1993 butter consump-

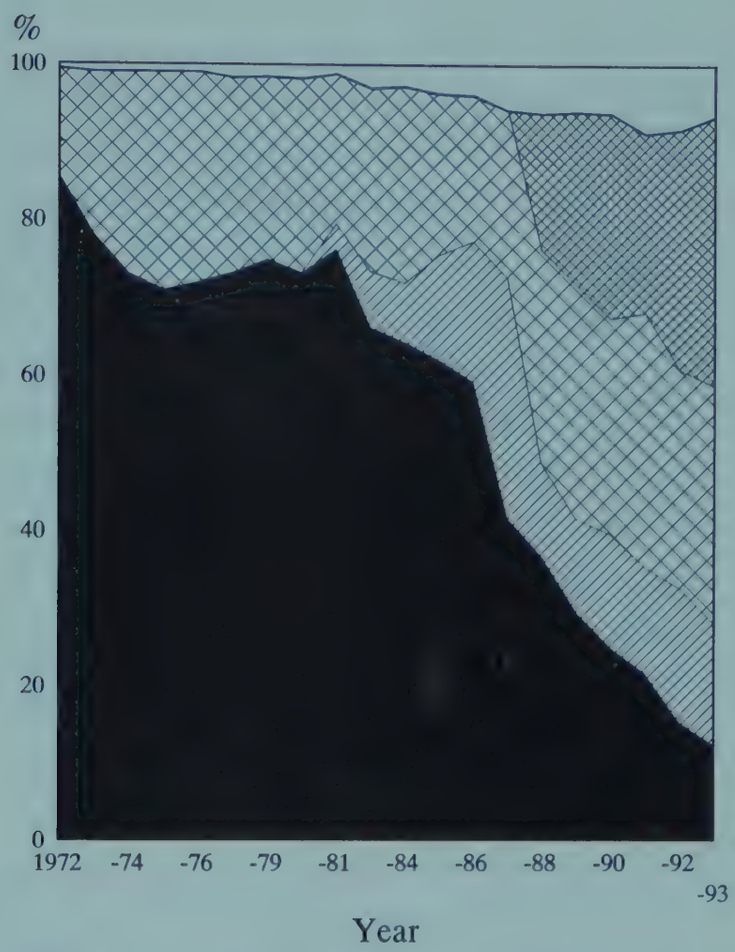

Figure 11.3. Fat consumed on bread in North Karelia among 25–59 year old men in 1972–93.

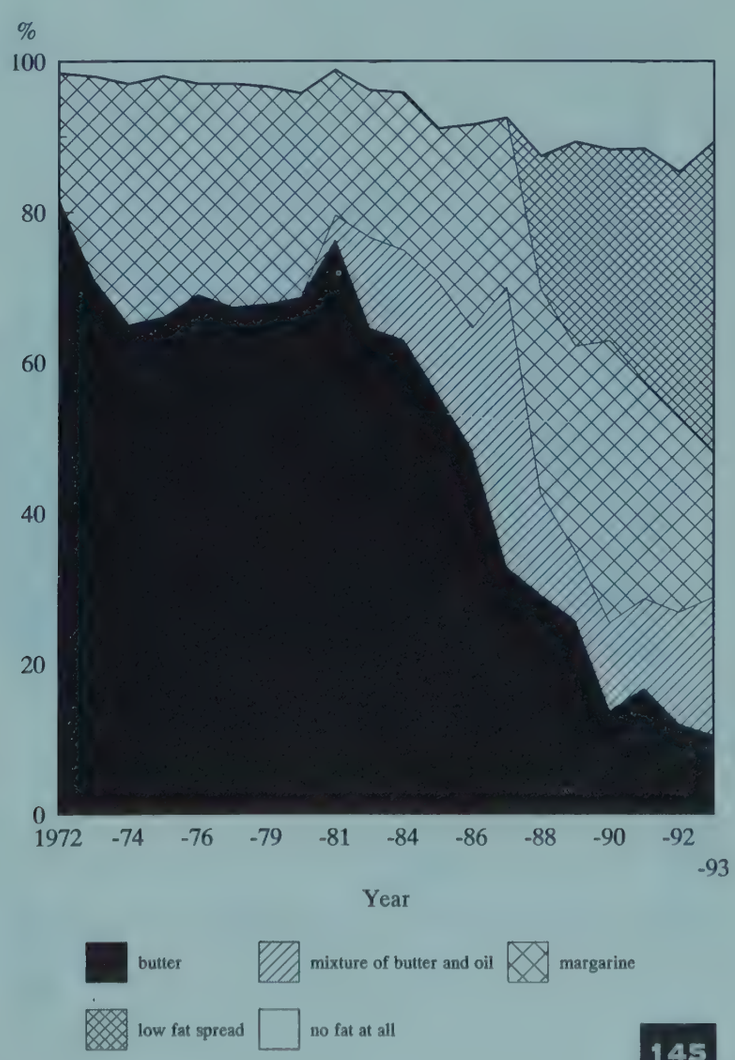

Figure 11.4. Fat consumed on bread in North Karelia among 25–59 year old women in 1972–93.

tion on bread was the habit among 12 % of men and 8 % of women, and low fat spread among 32 % and 35 %, respectively. In 1972, only 2 % of North Karelians used vegetable oil for cooking, while from 1973 to 1987 the figure was about 6 %. By 1993 nearly one third of the province's population was using vegetable oil for cooking (Figure 11.5).

Consumption of whole milk (fat 4.4 %) and "regular" milk (fat 3.9 %) were combined into a single category: the consumption of high fat milk. In 1972, 71 % of men and 57 % of women drank high fat milk, while by 1993 these proportions had shrunk to 14 % and 9 %. On the other hand, consumption of "low fat" milk (fat 2.5 %) rose from 1972 to 1976 among both sexes. In 1976 the fat percentage of low fat milk was altered from 2.5 to 2.9 and its consumption decreased thereafter. Since 1983 the

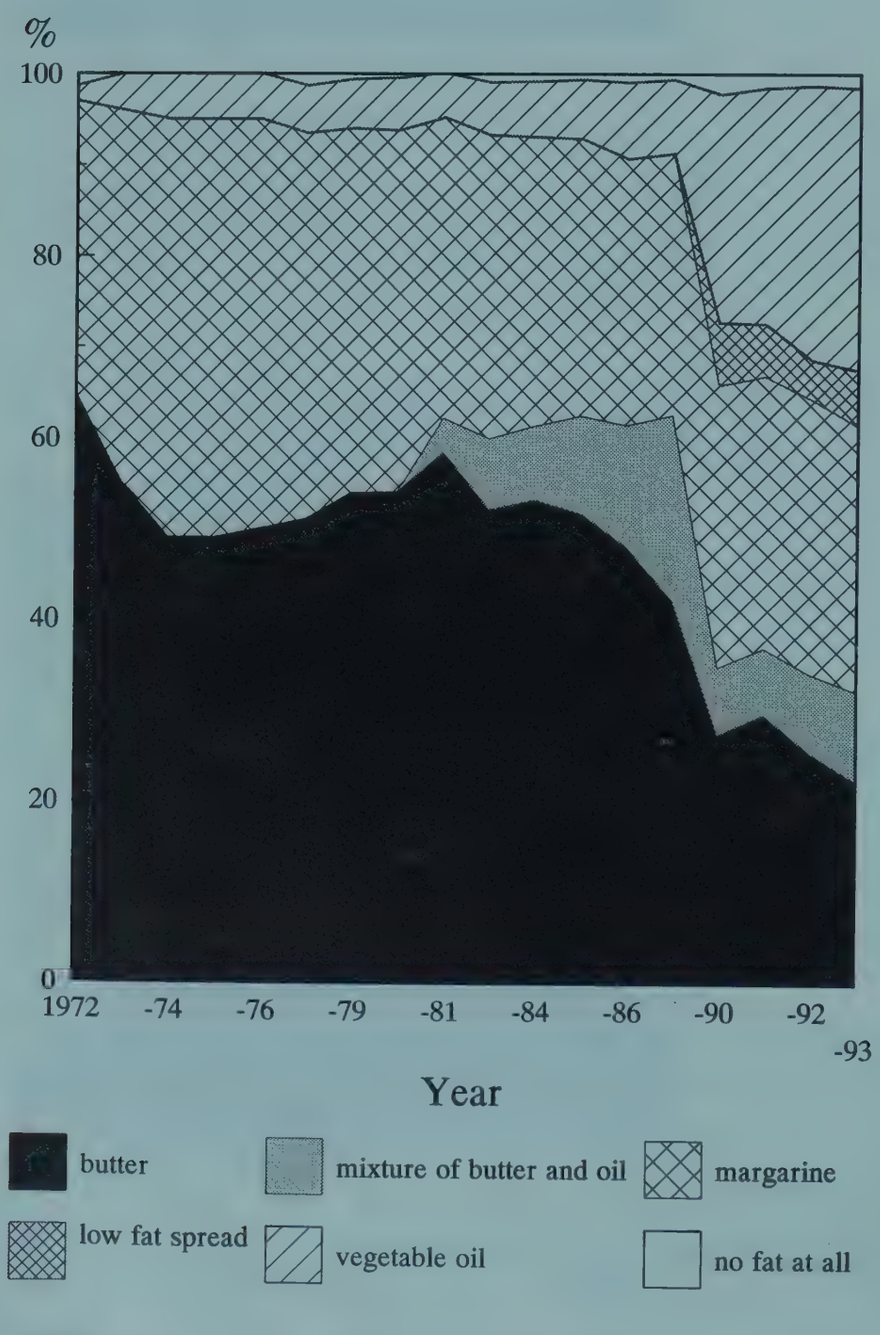

Figure 11.5. Fat used for cooking at home in North Karelia among 25–59 year old people in 1972–93.

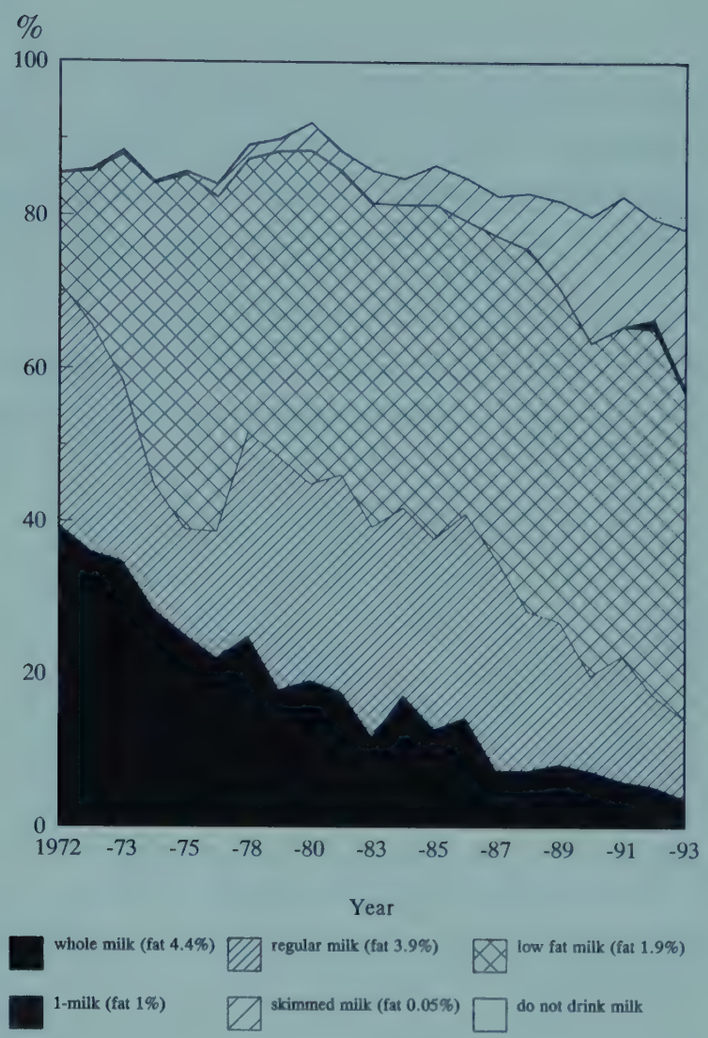

Figure 11.6. Type of milk usually consumed in North Karelia among 25–59 year old men.

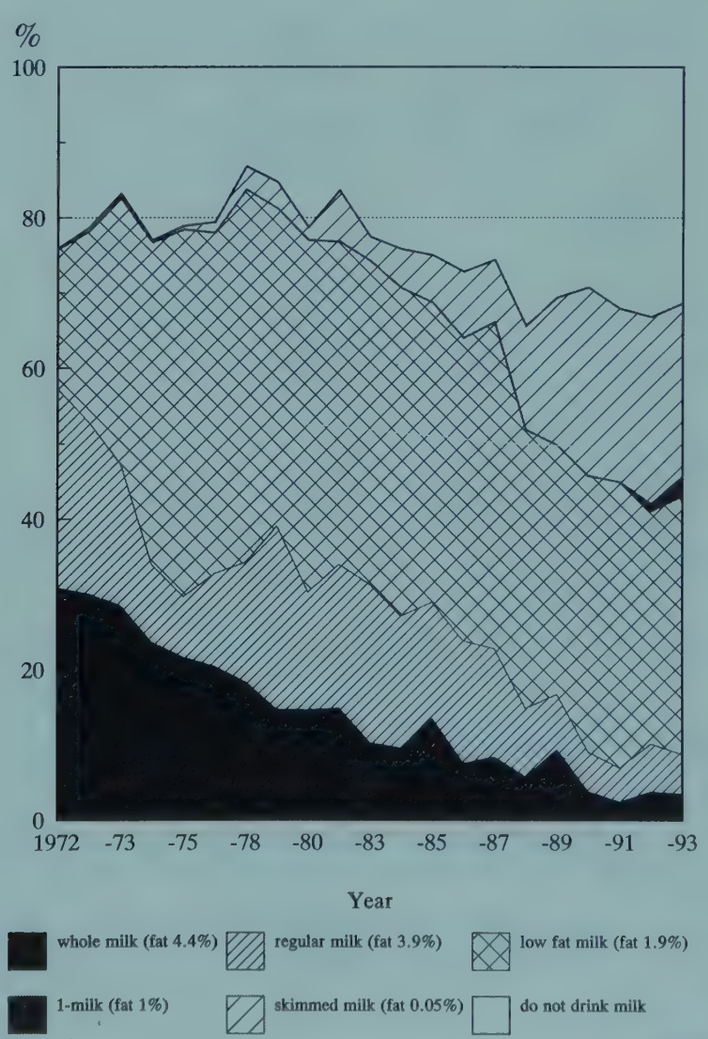

Figure 11.7. Type of milk usually consumed in North Karelia among 25–59 year old women.

fat percentage of "low fat" milk has been 1.9 and its consumption persisted at about 40 % among men and women during the period 1983–93. Use of skim milk (fat 0.05 %) has risen since the 1980s. In 1993, 21 % of men and 23 % of women in North Karelia used skim milk, while 21 % and 31 % respectively drank no milk at all (Figures 11.6 and 11.7). In the national sample, by comparison, 19 % of men and 27 % of women drank skim milk in 1993, and 23 % and 27 % did not drink milk.

Figure 11.8. Proportion (%) of those eating vegetables daily, drinking skimmed or 1-milk (1% fat) and using butter on bread in North Karelia, by gender in 1972–93.

From 1979 onwards, the consumption of vegetables was assessed as the eating of vegetables (potatoes excluded) in a salad or as such. From 1979 to 1993, the prevalence of eating vegetables 6–7 days a week grew from 10 % to 22 % among men and from 12 % to 36 % among women. The figure (Figure 11.8) displaying the consumption of vegetables also shows the trends in the use of butter on bread, and the change in the consumption of skim milk during the study period.

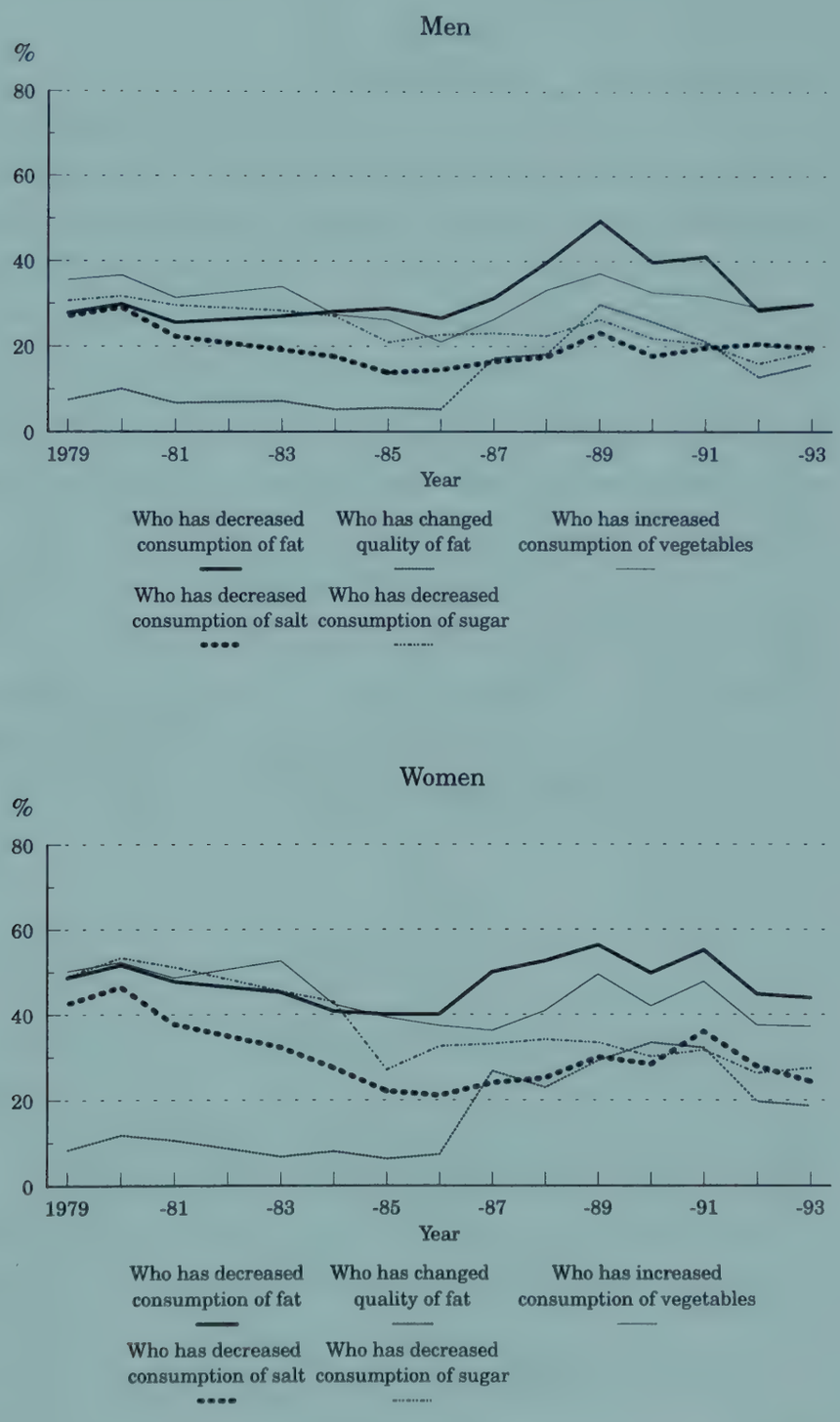

Figure 11.9. Proportion (%) of those who reported changes in some dietary habits in North Karelia in 1972–93.

The survey questionnaire also asked people to report whether they had made any changes in their diet for health reasons during the preceding year. From 1979 to 1993 the most commonly reported changes in dietary habits were reduced use of fat, increased consumption of vegetables, changed quality of fat, and less salt and sugar. In 1987–93 there were greater changes in dietary habits, especially among men. In the 1993 survey slightly over half the men and 70 % of the women reported having modified some dietary habits during the preceding year; 30 % of men and 44 % of women had reduced their use of fat, and 30 % and 37 % respectively had increased their consumption of vegetables (Figure 11.9).

3.3 Physical exercise

The proportion of people who engaged in leisure time physical activity at least twice a week rose between 1978 and 1993: from 35 % to 50 %

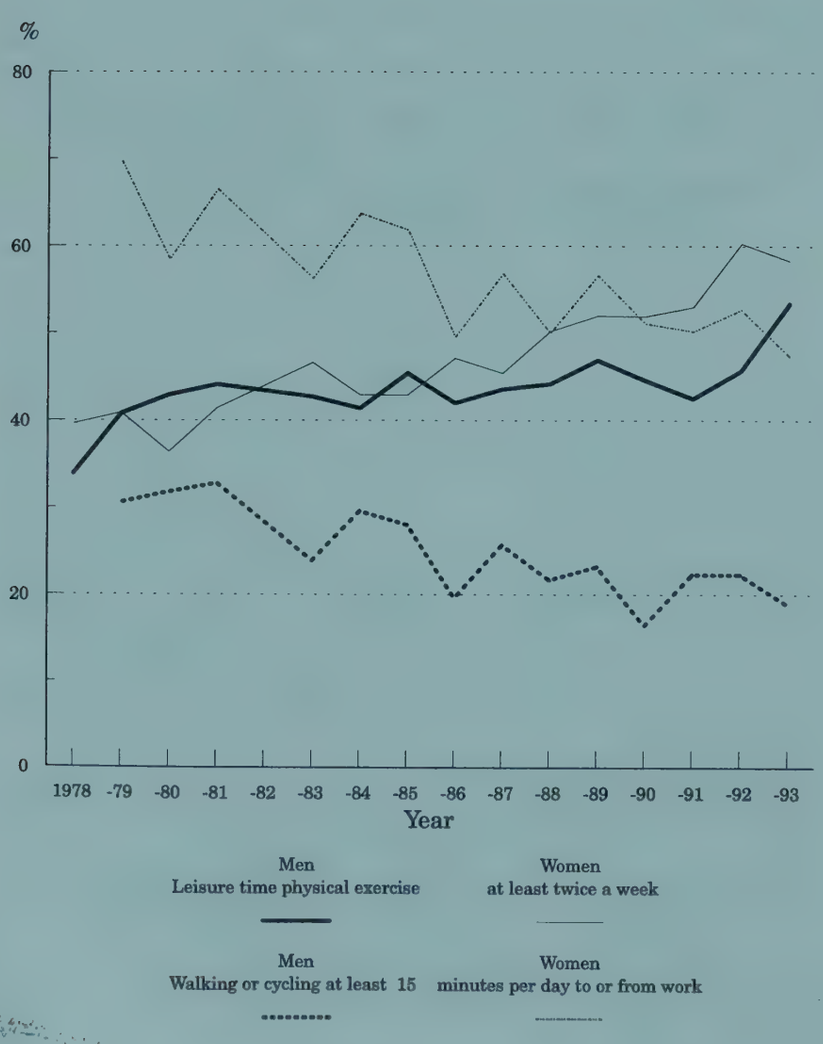

Figure 11.10. Proportion (%), by gender, of those undergoing leisure time physical exercise at least twice a week, and of those spending at least 15 minutes per day walking or cycling to and from work in North Karelia in 1978–93.

among men, and from 40 % to 60 % among women. In the national sample the corresponding changes were from 40 % to 50 % for men, and from 40 % to 55 % among women (Figure 11.10).

Between 1979 and 1986 the proportion of North Karelians reporting that they walked or cycled at least 15 minutes a day to and from work fell from 30 % to 20 % in men, and from 70 % to 50 % in women. Since 1986 the declining trend has continued – by about 20 % among men and 50 % among women (Figure 11.10).

3.4 Alcohol consumption

The proportion of men reporting alcohol use was about 85 per cent throughout the period 1982–93, while in women the rate increased from 65 % to 80 %. Beer drinking became more popular among both sexes; between 1978 and 1993 the proportion of people who had drunk beer during the previous week grew from 45 % to 65 % among men and from 15 % to 40 % among women. The proportion of medium strength beer drinkers has also increased, especially during the 1990s; in 1993, about 80 % reported drinking mainly medium strength beer.

The proportion of those who had drunk strong alcohol during the previous week has slightly decreased in North Karelia. The prevalence of wine drinking during the previous week rose from 15 % to 25 % among men, and from 15 % to 30 among women in 1982–93 (Figure 11.11).

3.5 Blood pressure and cholesterol measurements

In the spring of 1972, 28 % of men and 44 % of women reported that their blood pressure had been measured during the previous six months; 17 % of men reported that their blood pressure had never been taken, or they knew nothing about it, and the corresponding prevalence among women was 5 %. From 1973 to 1993 almost half of the men and 60 % of

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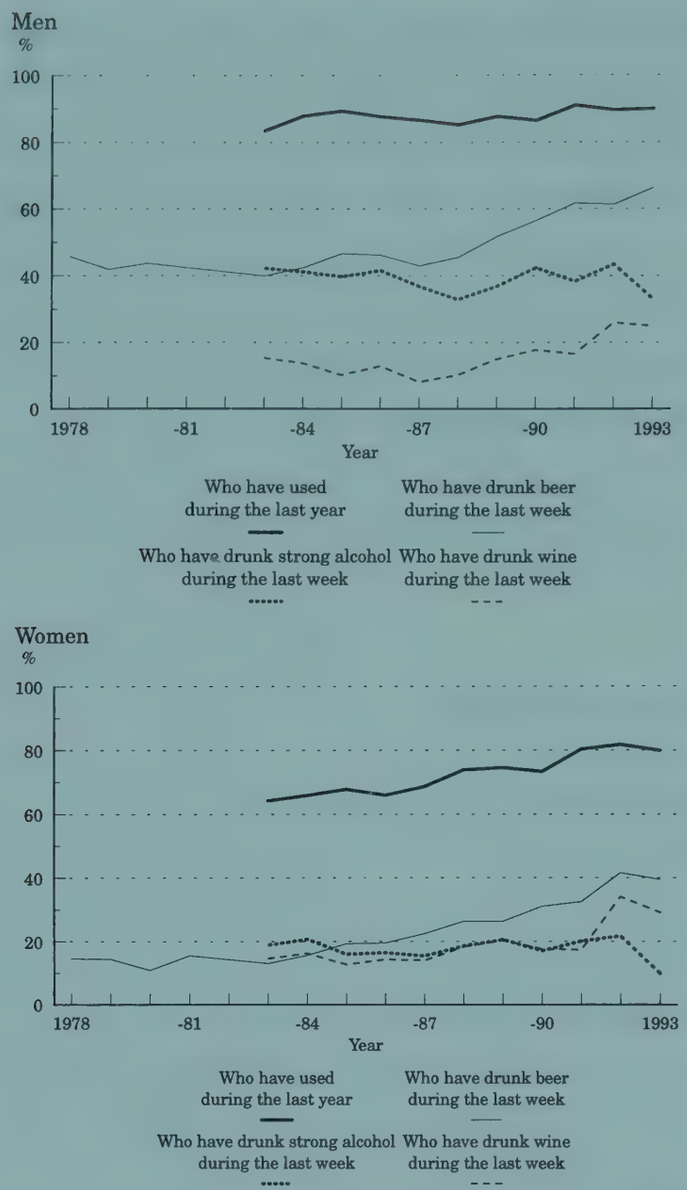

Figure 11.11. Proportion (%), by gender, of those drinking alcohol, and who had drunk beer, wine or strong alcohol during the past week, in North Karelia in 1978–93.

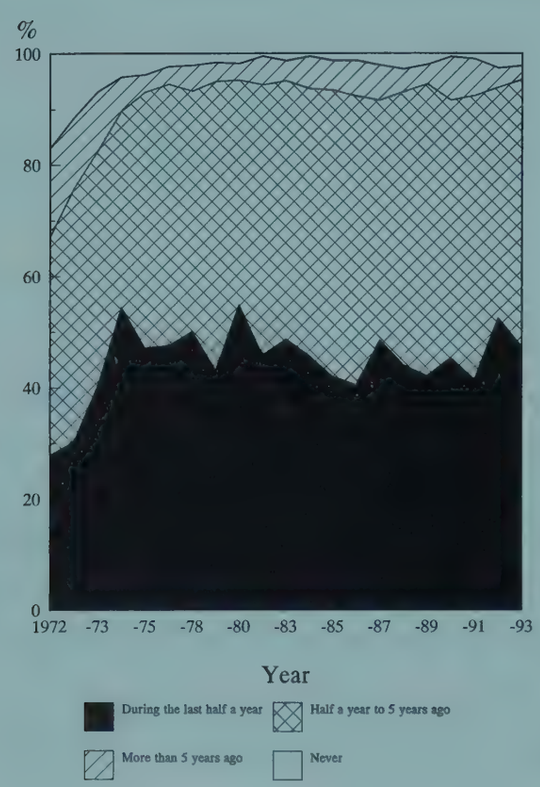

Figure 11.12. Time of last blood pressure measurement among 25–59 year old men in North Karelia in 1972–93.

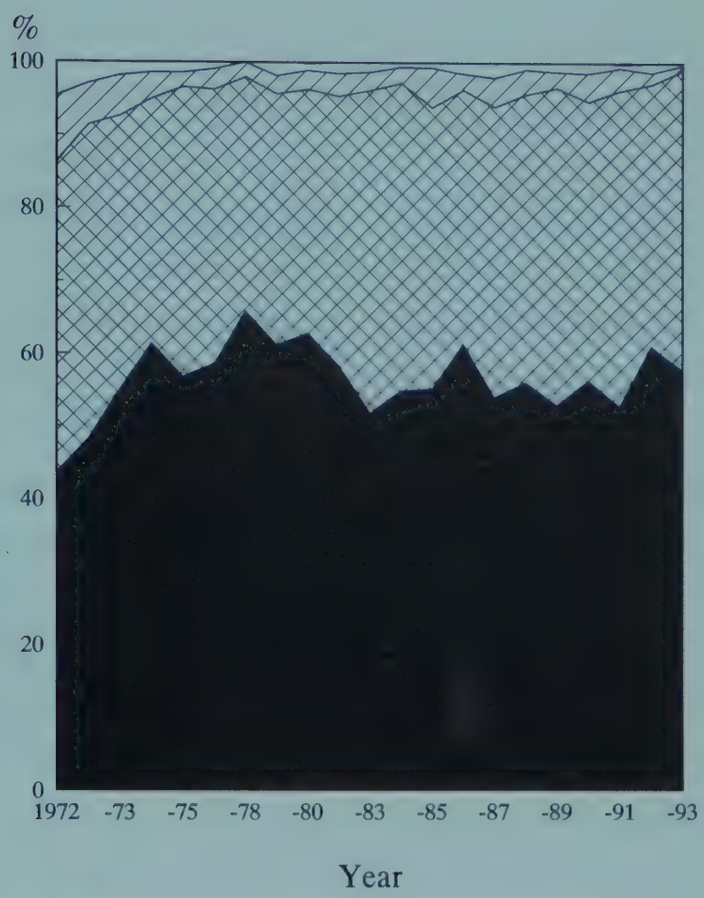

Figure 11.13. Time of last blood pressure measurement among 25–59 year old women in North Karelia in 1972–93.

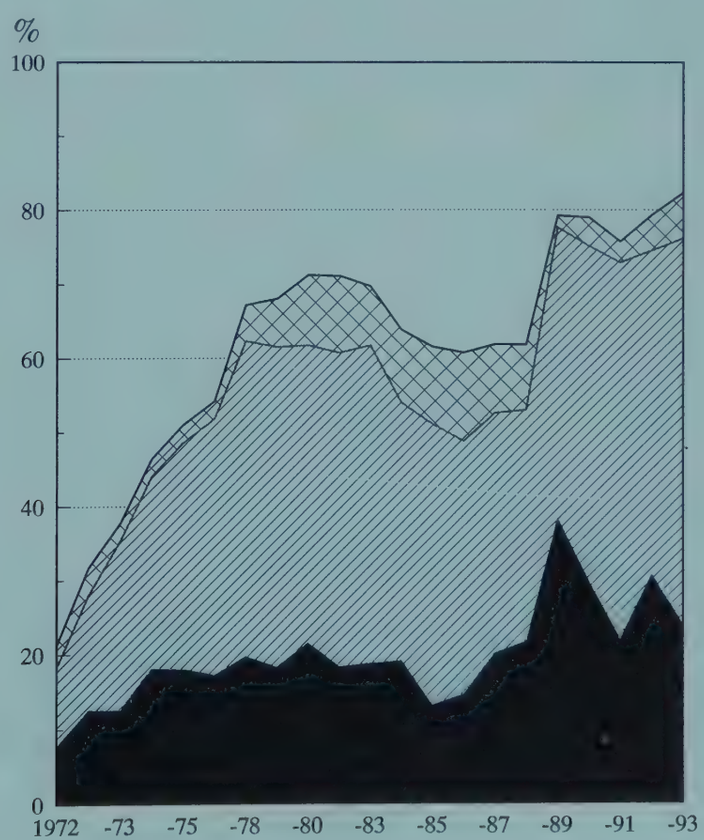

Figure 11.14. Time of last cholesterol test among 25–59 year old men in North Karelia in 1972–93.

the women reported a blood pressure measurement during the previous six months. By 1993 less than 2 % cent of both sexes reported that their blood pressure had never been measured (Figures 11.12 and 11.13).

In 1972, 8 % of men and 6 % of women in the province reported that their serum cholesterol had been measured during the previous half year, with about 80 % of both sexes reporting that it had never been measured, or they knew nothing about it. Blood cholesterol measurement rates increased sharply in 1972–78 and again in 1988–89.

By 1993, the proportion of those reporting that their serum cholesterol had never been tested had decreased to about 20 % in men and 15 % in women. Till the end of the 1980s serum cholesterol testing was more common among men than women, while since 1988 it has been almost equal (Figures 11.14 and 11.15).

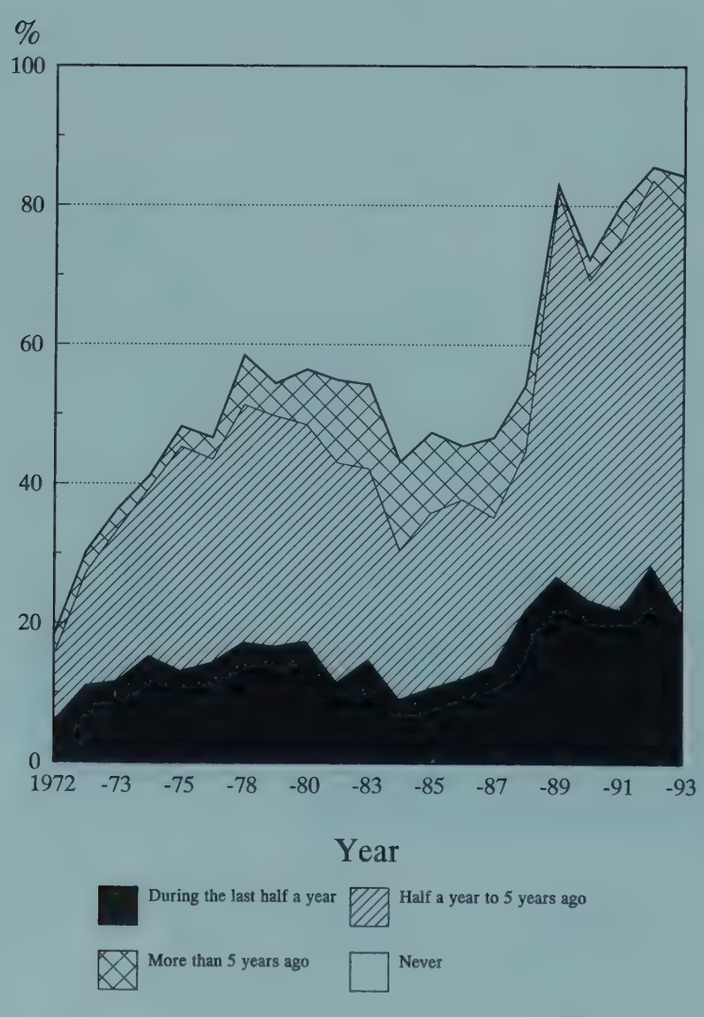

Figure 11.15. Time of last blood cholesterol test among 25–59 year old women in North Karelia in 1972–93.

4. DISCUSSION

Health behaviour changes in North Karelia have been substantial over the study period, particularly in dietary habits. In 1972 over 80 % of the province's citizens used mainly butter on bread, while this had declined to just 10% in 1993. The prevalence of high fat milk consumption dropped among men from 70 % to 14 %, and among women from nearly 60 % to 10 %. The alcohol consumption in North Karelia grew during the study period, but only from wine and beer. Leisure time physical activity increased steadily.

The prevalence of smoking among men decreased from 51 per cent to 36 per cent. Smoking among women in North Karelia increased from 12 % to 16 % and has remained on a lower level than in the national sample. It should be noted that the criteria used for current smoking are broader than for daily smoking. Thus the respective rates for daily smoking in 1993 were 33 % for men and 14 % for women.

Blood pressure measurements became much more common in 1972–74, especially among men, and the rate has since remained surprisingly stable. Blood cholesterol testing also increased sharply during the initial project phase in 1972–78, and then again in connection with the North Karelia Cholesterol Project in 1988–89.

Although the postal survey used for health behaviour monitoring cannot supply very detailed data on health related lifestyles, the trends observed are likely to be largely valid because the method has stayed very similar throughout. The more detailed published reports provide a good deal of extra information on health behaviour in different subgroups of the population (Helakorpi et al. 1993).

In addition to serving project evaluation needs, the health behaviour monitoring system has proved a remarkably useful intervention tool, both in North Karelia and nationwide. The favourable trends have been communicated back to people via the media and health education materials, in order to encourage and reinforce attitudes to the recommended lifestyle changes. On occasions, the survey has also been exploited to raise concerns and to direct health promotion activities to subgroups in particular need.

Ensuring that the latest trends in health and health education remain newsworthy issues has proved a very helpful strategy for keeping health-related lifestyles firmly in the "public agenda".

REFERENCES

Berg, M-A.,Helakorpi, S., Puska, P. Health Behaviour among Finnish Adult Population Spring 1993. Publications of the National Public Health Institute B10/1993. Helsinki 1993.

Helakorpi, S., Berg, M-A., Puska, P. Health Behaviour among North Karelian Adult Population in 1992–93. Publications of the National Public Health Institute B11/1993. Helsinki 1993.

Puska, P., Rimpelä, M., Sievers, K., Tuomilehto, J., Virtamo, J., Prunnila, T., Karjalainen, Y. Pohjois-Karjala projektin peruskartoitus: toteutus ja taulukot. Kuopion korkeakoulun julkaisuja B1/1973. Kuopio 1973.

Puska, P., Rimpelä, M., Tuomilehto, J., Virtamo, J., Karjalainen, Y. Pohjois-Karjala projektin tilannekartoitus n:o 1 – syksy 1972. Kuopion korkeakoulun julkaisuja B5/1973.Kuopio 1973.

WHO. Community control of cardiovascular diseases. Evaluation of the comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland 1972–1977. WHO Regional Office for Europe, Copenhagen 1981.

III

Mortality and Morbidity

12. MORTALITY CHANGES

Pekka Puska,
Jaakko Tuomilehto,
Erkki Vartiainen,
Heikki J. Korhonen and
Jorma Torppa

1. BACKGROUND

The North Karelia Project was launched when CVD – especially ischaemic heart disease (IHD) – mortality rates were exceptionally high in Finland, particularly in the eastern regions (Karvonen et al. 1967, Keys 1980, Pisa et Uemura 1982).

The main objective at the outset was to achieve a substantial decline in this mortality, especially among middle-aged men. When the project joined the WHO CINDI and INTERHEALTH programmes later on, there was a greater emphasis on more integrated needs of non-communicable disease (NCD) prevention.

Earlier publications from the North Karelia Project team reported a major decline in IHD mortality. The analyses also showed that in the 1970s this decline was significantly greater than in the reference province of Kuopio (Salonen et al. 1983). As the follow-up continued in the 1980s, the IHD mortality was observed to stabilize (Tuomilehto et al. 1989).

This chapter presents and analyzes the 20 year trends in IHD and other NCD mortality in North Karelia and all Finland.

2. MATERIAL AND METHODS

The mortality data for North Karelia and all Finland were obtained from the Central Statistical Office of Finland, which reviews the diagnoses made by local doctors on individual death certificates according to the International Classification of Diseases (ICD). The 8th revision of the ICD was used in Finland from 1969 to 1986, and the 9th revision there-

after. The following ICD codes were used for the mortality categories: cardiovascular diseases 390–459, ischemic heart disease 410–414, cancers 140–239, and lung cancer 162.

The mortality rates were calculated on the basis of population data from the national population registry. Age adjustment was done using the Finnish population in 1972 as standard. The mortality trends for North Karelia and Finland, their changes and the 95 % confidence intervals, were calculated using a general linear models procedure (GLM procedure of the SAS statistical software, SAS Institute 1985). To calculate the differences between the trends and their statistical significance, the logarithms of the mortality rates were used as dependent variables. Year, area and year-area interaction were used as independent variables.

3. RESULTS

There was a remarkable decline in CVD and cancer mortality among the male population aged 35–64 years in North Karelia and all Finland after the pre-programme period (1968–71). When the observation was divided into the two sub-periods 1969–81 and 1982–92 (Figures 12.1 and 12.2) it can be seen that the 1970s saw a sharper decline in IHD

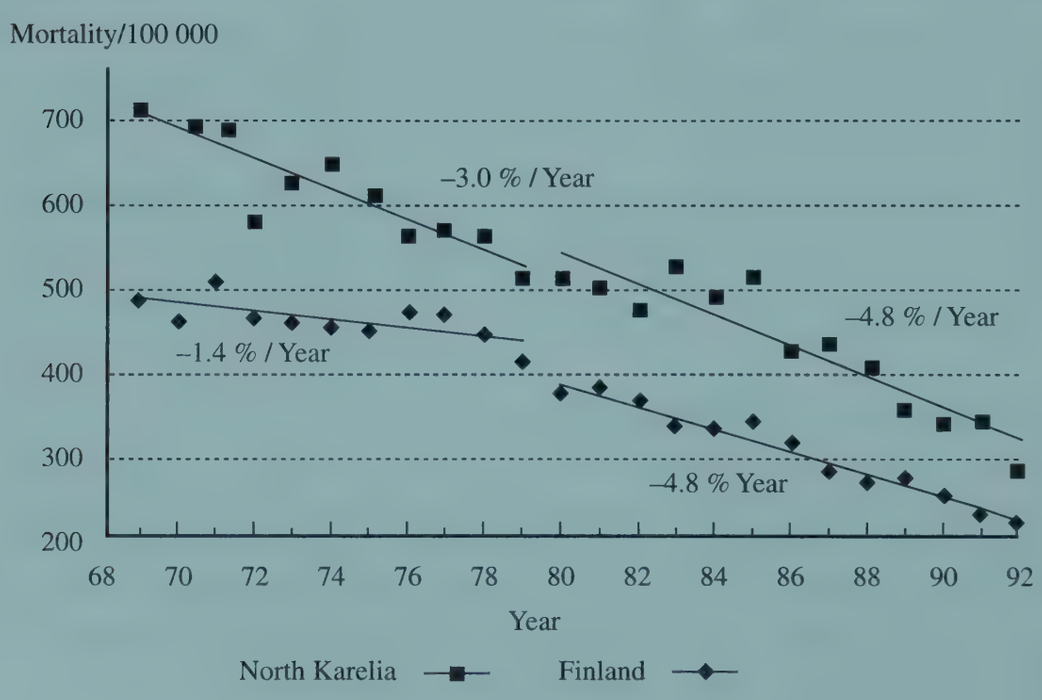

Figure 12.1. Mortality from coronary heart disease (men 35–64 years)

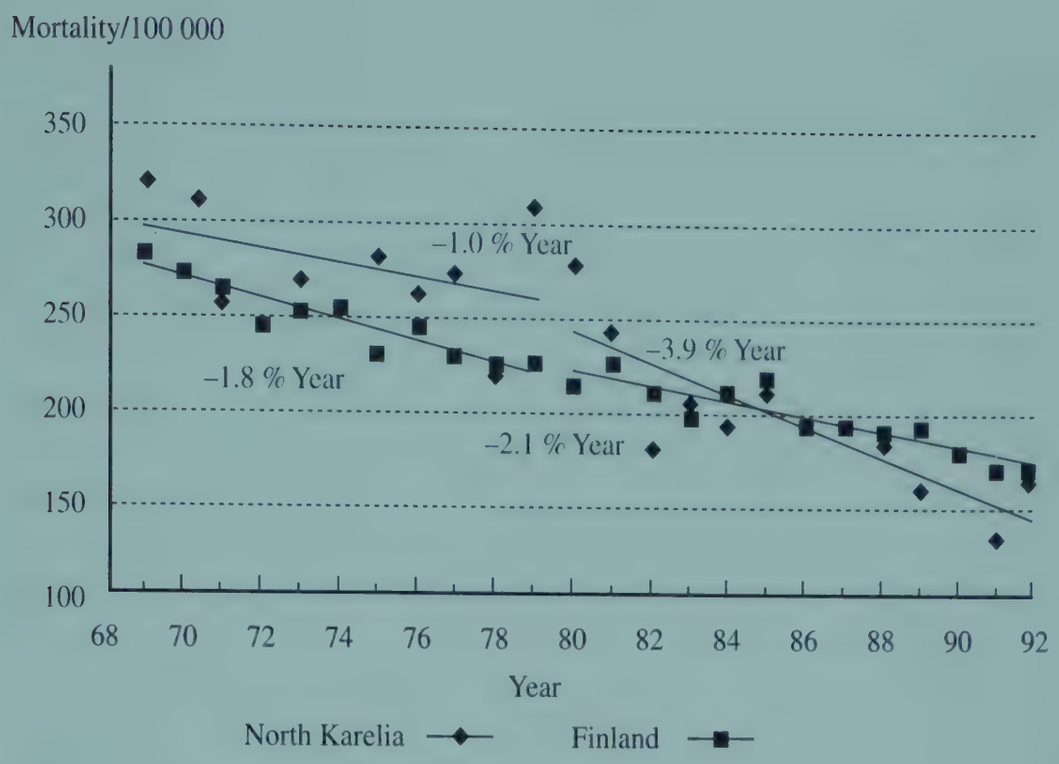

Figure 12.2. Mortality from cancer (men 35–64 years)

among men in North Karelia than in all Finland. Thereafter the decline in both steepened even further, but Finland steadily caught up with the development in North Karelia.

The decrease in cancer mortality among men in North Karelia and all Finland was rather similar in the 70s, but in the following decade it was steeper in North Karelia, largely due to the changes in lung cancer mortality. The mortality data on time trends have been used in Figures 12.3 and 12.4 to illustrate the relative (i.e. percentage) change in IHD and cancer mortality among men after the pre-programme period.

Figure 12.5 shows the decline in IHD mortality in North Karelia in 10 year age groups. The relative decline was clearly greater among the younger age groups, especially in men.

Tables 12.1 and 12.2 show the age-adjusted mortality rates among the 35–64 year old male and female population in all Finland and in North Karelia in 1969–71 (pre-programme period) and 1990–92. Before the programme began the mortality in Finnish males was exceptionally high; the approximate male/female ratio for IHD was 5, for cancer 2 and for total mortality 3. The mortality rates in North Karelia were generally higher than in all Finland, except for women's cancer and violent deaths.

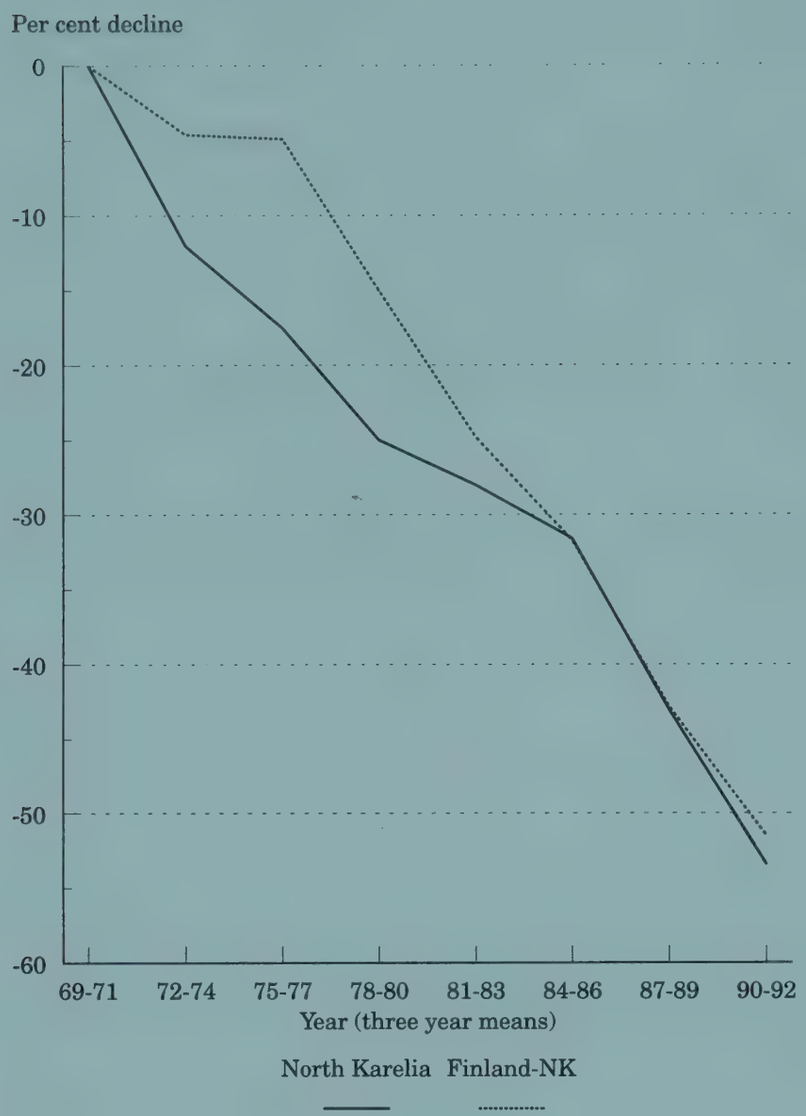

Figure 12.3. Per cent decline in CHD mortality among men (35–64 year) in North Karelia and all Finland

From 1969–71 to 1990–92 a substantial decline was seen in all major causes of mortality, except for violent causes and female cancers. The decline in CVD mortality (over 50 % in men and 60 % in women) was due to reduced mortality from both ischaemic heart disease and cerebrovascular disease.

From 1969–71 to 1990–92 the declines in all cause and CVD mortalities were much the same in North Karelia and all Finland. Cancer mortality among men declined significantly more in North Karelia (46.1 %) than in all Finland.

If the very last year of follow-up (1992) is used, the decline in CVD mortality in men from the pre-programme period was 57 % in North Karelia and 52 % in all Finland. The respective figures for IHD mortality are 59 % and 54 %.

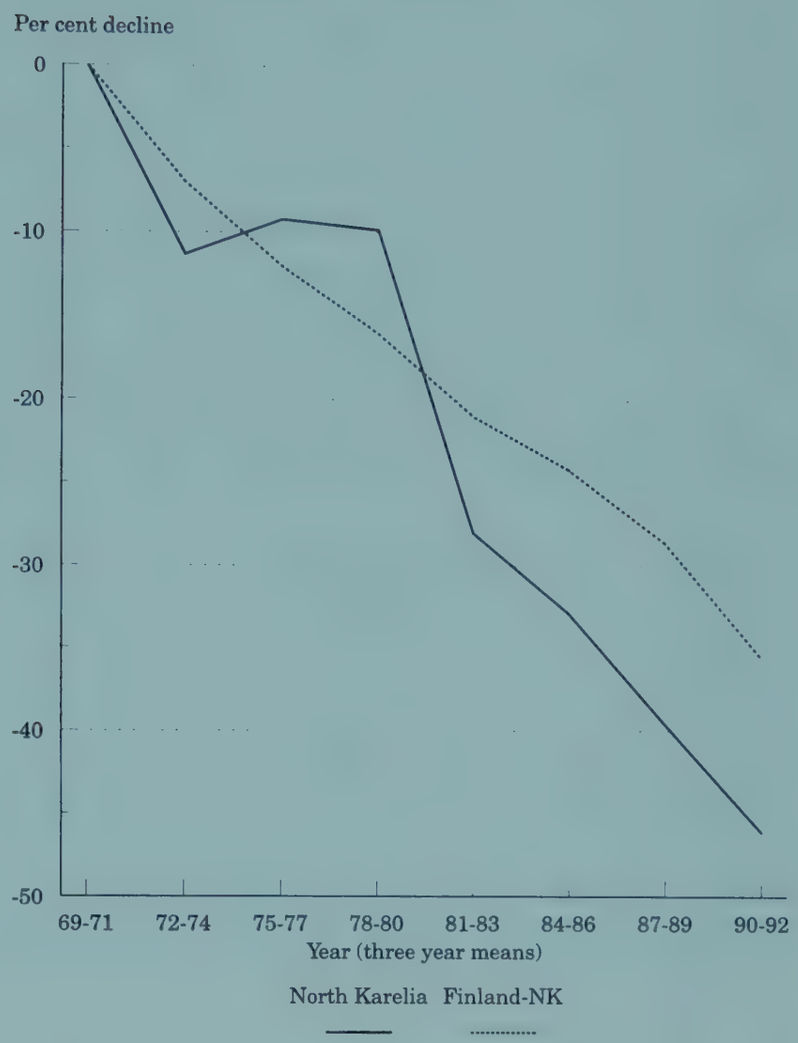

Figure 12.4. Per cent decline in cancer mortality among men (35–64 year) in North Karelia and all Finland

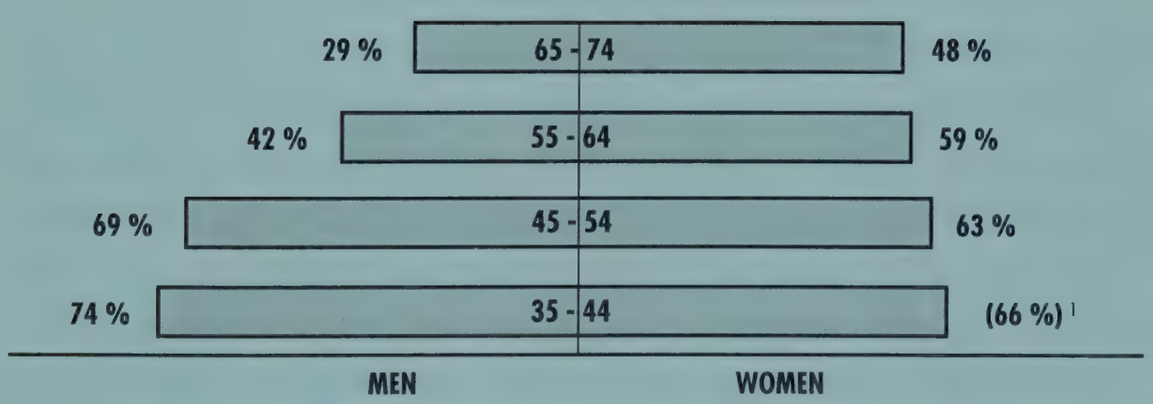

Figure 12.5. Percent decline in CHD mortality in North Karelia from 1969–71 to 1990–92 in different agegroups. [1]very few cases.

MORTALITY	ALL FINLAND	NORTH KARELIA
ALL CAUSES		
1969-71	1358	1598
1990-92	845	966
% CHANGE	-37.8	-39.5
CARDIOVASCULAR DISEASES		
1969-71	697	911
1990-92	354	447
% CHANGE	-49.2	-50.1
ISCHAEMIC HEART DISEASE		
1969-71	501	715
1990-92	243	333
% CHANGE	-51.5	-53.4
CEREBROVASCULAR DISEASE		
1969-71	100	95
1990-92	52	55
% CHANGE	-48.0	-42.1
CANCER		
1969-71	270	297
1990-92	174	160
% CHANGE	-35.6	-46.1
VIOLENT CAUSES		
1969-71	202	224
1990-92	182	218
% CHANGE	-9.9	-2.8

Table 12.1. Age-adjusted mean annual mortality rates (per 100.000) in 1969–71 and in 1990–92 in all Finland and in North Karelia and respective changes among the 35–64 year old male population.

Table 12.3 shows the average annual number of deaths from all causes and from CVD in North Karelia and all Finland, in 1969–71 and in 1990–92. It can be seen that twenty years after the programme began, there were 2817 fewer deaths annually in all Finland and 202 fewer in North Karelia among men aged 35–74 years. For women the respective figures were 2787 and 164. In North Karelia 82 % and in all Finland 89 % of this decline was due to reductions in cardiovascular deaths.

Over the project period in this age group the number of deaths was about 50 000 less in all Finland and 3 800 less in North Karelia compared to the numbers if mortality had stayed at the pre-programme level. Life expectancy at birth rose from 66.4/74.6 years (males/females) in 1971, to 71.7/79.4 years in 1992.

MORTALITY	ALL FINLAND	NORTH KARELIA
ALL CAUSES		
1969-71	509	542
1990-92	322	323
% CHANGE	-36.7	-40.4
CARDIOVASCULAR DISEASES		
1969-71	224	288
1990-92	85	105
% CHANGE	-62.1	-63.5
ISCHAEMIC HEART DISEASE		
1969-71	92	132
1990-92	40	53
% CHANGE	-56.5	-59.8
CEREBROVASCULAR DISEASE		
1969-71	74	70
1990-92	26	35
% CHANGE	-64.9	-50.0
CANCER		
1969-71	150	130
1990-92	133	108
% CHANGE	-11.3	-16.9
VIOLENT CAUSES		
1969-71	42	32
1990-92	48	45
% CHANGE	+14.3	+40.6

Table 12.2. Age-adjusted mean annual mortality rates (per 100.000) in 1969–71 and in 1990–92 in all Finland and in North Karelia and respective changes among the 35–64 year old female population.

4. DISCUSSION

The findings show a marked decline in the mortality rate of the middle-aged population. The decline in IHD mortality started in North Karelia very soon after the intervention began. In the 70s there was a significantly steeper decrease in North Karelia than in all Finland or Kuopio (Salonen et al. 1981), which corresponds with the clearly greater reduction in the risk factors there during the decade. Thereafter the trend somewhat levelled off in North Karelia, and was soon caught up by the steeper decline in all Finland.

During the last few years the decline has again been very steep in North Karelia. In 1992 the IHD mortality rate in North Karelia was 59 % lower, and preliminary information indicate that in 1994 it was 65 % lower, than the preprogramme (1969–71) rate.

	MEN				WOMEN			
	ALL CAUSES		CVD		ALL CAUSES		CVD	
	35-64	65-74	35-64	65-74	35-64	65-74	25-64	65-74
NORTH KARELIA								
1969-71	479	313	273	185	184	264	99	169
1990-92	318	272	143	145	106	178	34	93
	161	41	130	30	78	86	65	76
ALL FINLAND								
1969-71	9617	6831	4910	3820	4407	5835	1957	3561
1990-92	7489	6142	3028	3220	2975	4480	767	2228
	2128	689	1882	600	1432	1355	1190	1333

Table 12.3. Average annual number of deaths of all causes and of CVD in North Karelia and in all Finland in 1969–71 and in 1990–92.

The development in CVD mortality was very similar among women, too. In fact, the relative decline was, if anything, a little greater than among the men.

A major decrease also took place in cerebrovascular disease mortality. Thus the decline in total cardiovascular disease mortality was of the same magnitude as for ischaemic heart disease.

The decline in cancer mortality in North Karelia became more pronounced than in all Finland only during the second 10-year period. The 21-year decline in cancer mortality among men was significantly greater in North Karelia than all Finland (46.1 % vs. 35.6 %). The relative decline in cancer mortality in North Karelia over this period was considerable and nearly as large as for cardiovascular diseases.

Although the mortality data are based on routine sources, they are likely to be quite valid for the middle-aged population. For site-specific cancers the numbers of deaths in North Karelia are small. The reduction in lung cancer mortality, however, was significantly greater than in all Finland, which accords with the smoking figures. The proportion of male smokers has declined in all Finland since the early 1960s, but in the 1970's the decrease was considerably greater in North Karelia than in the reference area (Vartiainen et al. 1991). Allowing for a relatively long incubation period, the impressive downward trend of lung cancer mortality in North Karelia, particularly during the 1980's, is in good agreement with the smoking changes.

Changes in violent deaths were generally quite small. Among women the numbers were especially small in North Karelia at the outset. Generally, traffic accident mortality has decreased, while alcohol-related accident mortality has increased along with the overall rise in alcohol consumption. It is worth mentioning that a prospective study of the 1972 population sample found that serum cholesterol was not associated with risk of violent death, while smoking and alcohol consumption were positively associated (Vartiainen et al. 1994).

Thus, there has been a remarkable decline in mortality among the middle-aged population in association with the risk factor reduction. This has particularly concerned CVD in both sexes, and cancer among men. Some 3 800 premature deaths have been prevented in North Karelia and 50 000 in the whole of Finland.

A separate analysis has shown that the observed reductions in population risk factor levels can explain most of the decline in CHD mortality (Vartiainen et al. 1994). Of the single risk factors, reduction in serum cholesterol level had the greatest impact.

It is thus likely that most of the extraordinary decline in CVD and cancer rates has been due to the reduction achieved in target risk factors, i.e. to primary prevention. Concurrent improvements in therapy have also naturally contributed to these favourable developments.

13. TRENDS IN ACUTE MYOCARDIAL INFARCTION AND CORONARY DEATH IN NORTH KARELIA – RESULTS FROM THE AMI REGISTER

Harri Mustaniemi

1. INTRODUCTION

The AMI register for North Karelia began operating on May 1st 1972, as the project was getting underway. All men and women in the province suspected of having acute myocardial infarction (AMI) or coronary death were included in the register as soon as possible, even if dead when registered. In the first few years there was no upper age limit, but since 1978 only victims under 65 years old have been registered.

In the early 80s, a new IHD register protocol was developed in connection with the WHO MONICA Project. This was founded on the earlier WHO IHD Register Project and on experiences gained in the United States.

Until 1982 the AMI register procedure in North Karelia was based on the old WHO recommendations (WHO 1971); this is referred to here as the WHO71-period. In 1982 the MONICA register criteria (WHO 1990) were applied. After ten years of the MONICA Project (called FINMONICA in Finland), the registration continues in a limited area, and is now known as the FINAMI Project (Table 13.1).

FROM	TO	CRITERIA USED	AGE GROUP (YEARS)	NAME USED
1972	1977	WHO (1971)	25-	(WHO71)
1978	1981	WHO (1971)	25-64	(WHO71)
1982	1992	MONICA	25-64	FINMONICA
1993		MONICA	25-74	FINAMI

Table 13.1. Periods of AMI registration in North Karelia.

The FINMONICA Project and its continuation phase comprise, in addition to North Karelia, the two monitoring areas of Kuopio, and Turku/Loimaa in southwestern Finland.

2. METHODS

2.1. THE REGISTRATION IN PRACTICE

The unit of registration was a 28 day event; an AMI recurring during the 28 day period was not registered as a new event. Information collected from the patient records was used to distinguish the first myocardial infarction from recurrent ones.

The registration included all deaths attributed by death certificates to IHD and all non-fatal events clinically diagnosed as acute myocardial infarction occurring to men and women aged over 25 years.

The province's specialized central hospital in Joensuu had 99–167 beds during the study period, plus a coronary care unit with eight beds. About 70–75 % of AMI patients under 65 years were treated in the central hospital and most of the rest in four health centre wards.

The AMI Register was located at the central hospital and had a register nurse who interviewed the patients and gathered all other information on the events. She used standardized record forms which were versions of the originals used in the WHO register and MONICA studies. Despite simplifications and protocol modifications, all important details on the current event were included in all versions. The items were: gender, birth date, date of onset of attack, survival at 28 days, symptoms, electrocardiogams (ECG), enzymes, diagnostic category and clinical diagnosis, death certificate diagnosis and necropsy findings.

One or two of the ward nurses at each local health centre treating AMI patients were designated as register nurses responsible for gathering data on patients treated there. The record forms and complementary medical data, plus ECGs and data on cardiac enzymes, were sent to the registry at the central hospital where the data were scrutinized and complemented. The final diagnostic classification of both fatal and non-fatal cases was made by the registry doctors.

Non-fatal events were classified as definite, possible, no myocardial infarction and, from 1982, ischemic cardiac arrest. The categories of fatal events were definite AMI, possible AMI or coronary death, insufficient data, and no AMI/coronary death.

The principal register sources of non-fatal events were the daily hospital records, because practically all patients diagnosed with AMI were treated as inpatients in the central hospital or health center wards. This made it possible to actively screen the admissions and to interview patients – the "hot pursuit" approach (Tunstall-Pedoe 1988). So-called silent AMIs were not included.

Living patients were usually identified and registered on the basis of typical retrosternal pain, without waiting for the final clinical diagnosis. In some cases the clinical picture was dominated by dyspnoea, a sense of suffocation, indigestion, general malaise etc. If suspicion of AMI was strong enough, these cases were also registered. In some cases the decision to register was based on pathological laboratory or ECG findings.

Most of the fatal events were derived from the death certificate data. The registry nurse regularly monitored all death certificates for suspect events. Particularly in cases where autopsy was not performed, additional information was sought from old patient records and sometimes by interviewing relatives or other people who knew something relevant about the patient's history. This procedure left very few cases in which additional information was totally absent.

2.2. QUALITY CONTROL

Regular meetings were organized for the involved staff to maintain the quality and coverage of the register.

To check the consistency of the register's diagnostic classification in the 1970s, a random sample of 30 cases annually was blindly reclassified by the same doctor who made the initial classification. There was no significant divergence between the two classifications (Salonen et al, 1979). During the MONICA period beginning in 1982, repetitive quality control procedures were carried out, both internationally and internally (Tunstall-Pedoe, 1988 and 1989, Salomaa et al, 1992). The quality control centres for event registration (Dundee, Scotland) and for ECG

coding (Budapest) were responsible for providing training material. The MONICA Data Centre in Helsinki conducted logistic and consistency searches for possible duplicate registrations etc.

From the mid-1980s computerized data files of all hospital discharges in North Karelia were available. Lists of discharges with ICD codes 410–414 were produced regularly and used to ensure the completeness of registration. Similarly, the fatal event data recorded in the register were cross-checked with the official statistics in the National Death Certificate Register, and complemented when necessary.

2.3. The register criteria

The diagnostic classification was based on the following variables, used in both the old WHO and the MONICA criteria: 1) symptoms, 2) ECG findings, 3) enzyme findings, 4) autopsy findings, 5) history of previous AMI and 6) history of previous ischaemic heart disease, as described in many previous reports (e.g. Salomaa et al, 1992).

The two sets of criteria (old WHO and MONICA) differ in many respects, most obviously in their classification of the ECGs and enzymes. The ECG interpretation in the old WHO classification, which originated in the 1950s, is less exact than in the MONICA criteria, which is based on the Minnesota Code. Also, the former contained practically no definitions of the elevated enzymes, while in the MONICA classification the enzyme criteria are more detailed. These disparities mean that the results from these two periods of registration are not directly comparable (see Beaglehole et al, 1987).

There are also several details of the MONICA diagnostic criteria which are not included in the WHO71 criteria (Table 13.2).

Because the definition of the category "possible myocardial infarction" is rather loose for those surviving the attack, as shown by Palomäki (1989), the FINMONICA Project has modified this category by dividing it in two: "FINMONICA-possible" (in which there is an equivocal ECG and/or enzyme evidence of myocardial injury in addition to the typical history), and "Prolonged chest pain" (based mainly on the history) (Salomaa et al, 1992, Tuomilehto et al, 1992). The category FINMONICA-possible is combined with the definite category of the survived patients when incidence and attack rates are reported. This proce-

	HISTORY		ECG		ENZYMES	
	W	M	W	M	W	M
TYPICAL/UNEQUIVOCAL	+	+	+	+	+	+
ATYPICAL/EQUIVOCAL	+	+	+	+	+	+
NONEVOLVING (ECG)			(–)	+		
OTHER/NONSPECIFIC	–	+	+	+	–	+
NO FINDING/NORMAL	+	+	+	+	+	+
NONCODABLE (ECG)			–	+		
DEFICIENT	–	+			–	+
NO DATA	+	+	+	+	+	+

Table 13.2. Comparison between WHO71 (W) and MONICA (M) criteria. Criteria included (+) and not included (–) in the protocol.

dure modification was extended retrospectively to the period 1973–81, when the old WHO criteria were in use (Mustaniemi, 1993), and was also applied in this analysis.

The classification according to the modified FINMONICA criteria was as follows:

Non-fatal cases:

Definite MI:
definite ECG; or probable ECG with abnormal enzymes and symptoms which are typical, atypical or inadequately described*; or typical symptoms and elevated enzymes with ischaemic* or uncodable* ECG or ECG not available (cases with typical history, elevated enzymes and normal ECG which were definite according to the WHO71 classification were transferred to the "possible" category; see below).

FINMONICA-possible MI:
from the MONICA-category "possible MI": those with typical history and equivocal ECG changes, or typical history and borderline enzymes; or typical history, elevated enzymes and normal ECG; and, from the category No AMI: atypical history, equivocal ECG and borderline enzymes.

* not included in the WHO71-criteria

Prolonged chest pain:
typical history, but ECG and enzyme findings do not place the case into the definite or FINMONICA-possible category.

Other event:
combinations of symptoms, ECG's and enzymes not applicable to the categories decribed above.

Fatal cases:
the categories definite and possible MI/coronary death, and the category insufficient data.

The age-standardized rates were calculated by the direct method, using 5-year age groups and the 'World Standard Population'.

3. RESULTS

The following results are based on the analysis of the registered attacks among the residents of North Karelia aged 35–64 years from 1973 to 1992.

3.1. Registered attacks

Altogether, 14 031 suspected coronary events in the age group 35 to 64 years were registered during the study period 1973–1992. The attacks of 7385 men and 1788 women (total 9173) fulfilled the criteria of definite or FINMONICA-possible events, or (in the fatal cases only) insufficient data (Table 13.3). Over 70 % of the registrations were made at the Central Hospital of North Karelia and most of the remainder at the health centers in Ilomantsi, Juuka, Lieksa and Nurmes.

	CORONARY EVENTS	OTHER EVENTS	TOTAL
MEN	7385	3415	10800
WOMEN	1788	1443	3231
TOTAL	9173	4858	14031

Table 13.3. Registered events in the age group 35–65 years from 1973 to 1992: coronary events according to the FINMONICA-criteria and other events not fulfilling the criteria.

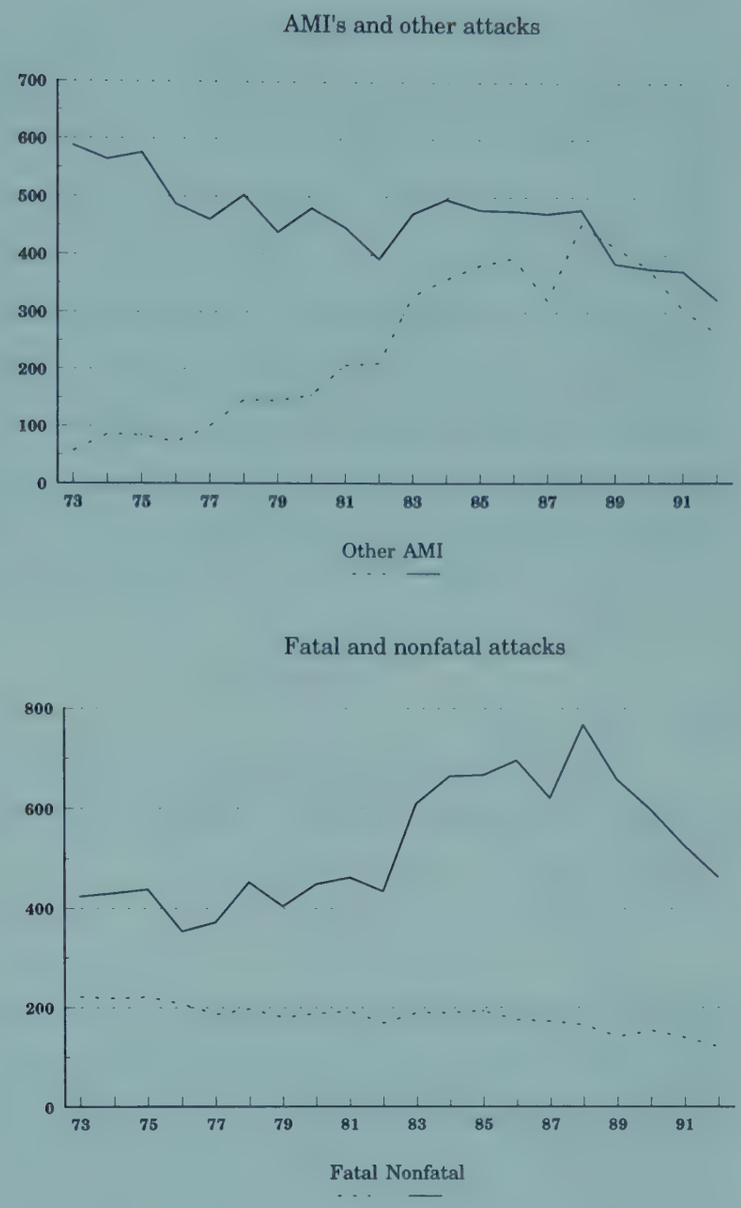

Figure 13.1.
Registered events.

Figure 13.1 shows that registration activity rose between the 70s and 80s; the number of events fulfilling the criteria declined, but non-AMI cases increased. As can be seen, this increase was due to greater registation of non-fatal events.

3.2. ATTACK RATE

The total number of severe acute coronary attacks (SACA) – AMI's and coronary deaths – was 9173, as mentioned above, with men having 7 385 (80%) and women 1788 (20%). In males, there were 3162 SACA attacks among the 35–54-year-olds and 4223 in the older age group. Women aged 55–64 had 1379 attacks fulfilling the criteria, while those aged 35–54 years suffered only 409 attacks, 4.5 % of the total (Table 13.4).

	NUMBER OF ATTACKS		
SEX AND AGE GROUP	**FATAL**	**NONFATAL**	**TOTAL**
MEN			
35-54	1080	2082	3162
55-64	1830	2393	4223
35-64	2910	4475	7385
WOMEN			
35-54	101	308	409
55-64	406	973	1379
35-64	507	1281	1788
TOTAL	3417	5756	9173

Table 13.4. Acute coronary events according to the FINMONICA-criteria in North Karelia from 1973 to 1992 in the age group 35–64 years.

Table 13.5 shows the declining trend in the annual attack rate of SACAs in men and women. The decline is evident in all age groups, though clearest in the younger men.

	MEN				WOMEN			
	35-54	**55-64**	**35-64**	**(95%CI)**	**35-54**	**55-64**	**35-64**	**(95%CI)**
73-75	1051	3054	1568	(1486-1650)	122	728	278	(246-310)
76-78	877	2576	1316	(1240-1392)	99	702	254	(224-284)
79-81	751	2509	1205	(1132-1278)	95	707	253	(223-283)
82-84	674	2562	1161	(1091-1229)	106	681	254	(223-285)
85-87	667	2576	1160	(1091-1229)	100	737	264	(233-295)
88-90	532	2282	984	(922-1046)	73	663	225	(197-253)
91-92*	448	1922	828	(731- 925)	54	516	173	(130-216)
* Average of 2 years								

Table 13.5. Age-adjusted CHD attack rate/year/100000 in three-year periods from 1973 to 1992.

The attack rate presented in Table 13.5 is calculated according to the FINMONICA-criteria, including the FINMONICA-possible non-fatal events. Figure 2 compares the FINMONICA attack rate with that based on the MONICA Project recommendations, in which only definite nonfatal attacks are included (called MONICA attack rate in this connection). The trends calculated in these two ways are almost identical.

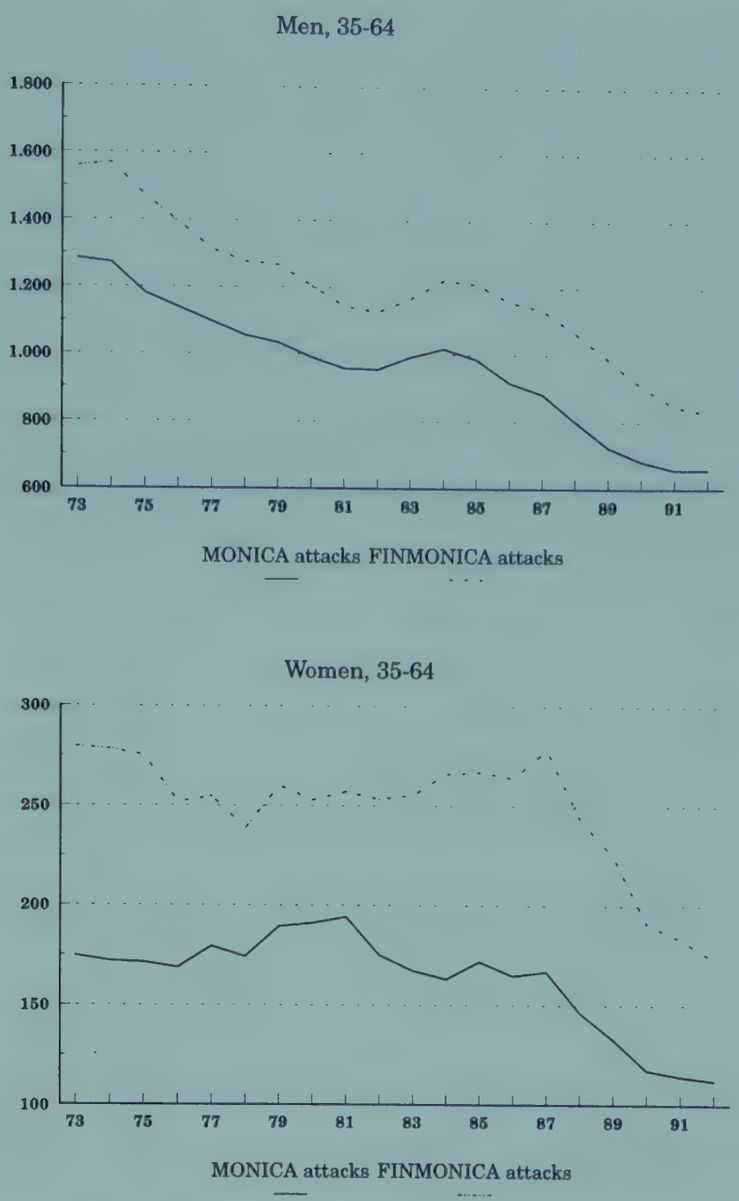

Figure 13.2. Coronary attack rate (per 100 000).

The rise of the attack rate in the early 1980s (Fig 13.2) is explained by the new register criteria used from 1982 on. The declining trend in the 70s repeated itself in the 80s, but from a higher level (in men only – women seem to have behaved differently).

The trends of the rate of all attacks and of the first attack (the incidence) are presented in Figure 13.3. During the WHO71 period from 1973 to 1981, the trends of the incidence and all attacks rate were exactly the same in men (–4.1 vs –4.0 %/year), while in women there was no statistical difference. From 1982 to 1992 the all attacks rate declined annually in men by 3.7 % (from –6.0 to –1.4 %) and that of the incidence by 2.2 %; the decline in recurrent attacks was 6.0 %.

Figure 13.3. Attack rate and incidence (per 100 000)

3.3. Mortality

Table 6 shows the age-adjusted CHD mortality from 1973 to 1992. Here, the declining trend is even more evident than in the all attacks rate.

Death before reaching hospital (prehospital mortality) is proportionally more common in men (over 70 % of mortality) than in women (about 60 %) (Figure 13.4). Both components of coronary mortality decline clearly; the smaller number of deaths in women compared to men makes evaluation of the female mortality difficult.

Mortality in the age group 35–64 has fallen by half in both sexes (Table 13.7). In men, the recurrent fatal attacks seem to have decreased more than the first ones; the same is true of the prehospital mortality in both sexes. The decline of mortality in the 35–54-year old men was 64 %, contrasting with 38 % in the age group 55–64 years.

	MEN				WOMEN			
	35-54	55-64	35-64	(95%CI)	35-54	55-64	35-64	(95%CI)
73-75	340	1357	602	(551-653)	25	260	86	(69-103)
76-78	311	1212	543	(494-592)	21	260	82	(65-99)
79-81	280	1111	495	(449-541)	24	240	80	(63-97)
82-84	247	1183	488	(443-533)	26	166	62	(47-77)
85-87	229	1032	436	(394-478)	29	176	67	(51-83)
88-90	162	908	355	(318-392)	19	169	58	(44-72)
91-92*	123	807	299	(241-356)	17	115	42	(21-63)

* Average of 2 years

Table 13.6. Age-adjusted CHD mortality/year/100000 in three-year periods from 1973 to 1992.

Figure 13.4. Mortality (per 100 000).

	MEN	WOMEN
MORTALITY		
- ALL ATTACKS	-49.6***	-47.8***
- 1ST ATTACK	-43.7***	-47.8***
- RECURRENT ATTACK	-56.2***	-47.3*
PREHOSPITAL MORTALITY		
- ALL ATTACKS	-47.7***	-54.2***
- 1ST ATTACK	-40.0***	-48.2**
- RECURRENT ATTACK	-57.2***	-64.6**
MORTALITY AFTER REACHING HOSPITAL		
- ALL ATTACKS	-56.0***	-35.9*
- 1ST ATTACK	-56.6***	-49.1
- RECURRENT ATTACK	-57.0**	-26.8
* p < 0,05 , ** p < 0,01 , *** p < 0,001		

Table 13.7. Percentage changes in CHD mortality in North Karelian men and women aged 35–64 years from 1973 to 1992.

3.4. Non-fatal attack rate

The change of register criteria naturally had a greater impact on the trends of non-fatal attacks; figure 13.5 shows the changes in fatal and non-fatal attack rates separately. The trends of non-fatal attacks differ in men and women because women have proportionally more FINMONICA-possible attacks than men.

The age-adjusted non-fatal attack rates are shown in Table 13.8. Here again is the trend in males aged 35–55 more favorable than in older men or women.

	MEN				WOMEN			
	35-54	55-64	35-64	(95%CI)	35-54	55-64	35-64	(95%CI)
73-75	712	1698	966	(901-1031)	97	468	193	(166-220)
76-78	567	1364	773	(715-831)	78	442	172	(147-197)
79-81	471	1398	710	(654-766)	71	467	173	(148-198)
82-84	427	1380	673	(619-727)	80	515	193	(166-220)
85-87	438	1544	724	(690-778)	71	560	197	(170-224)
88-90	370	1374	629	(579-679)	54	494	168	(144-192)
91-92*	326	1116	529	(451-607)	38	402	132	(94-169)
* Average of 2 years								

Table 13.8. Age-adjusted nonfatal CHD attack rate/year/100000 in three-year periods from 1973 to 1992.

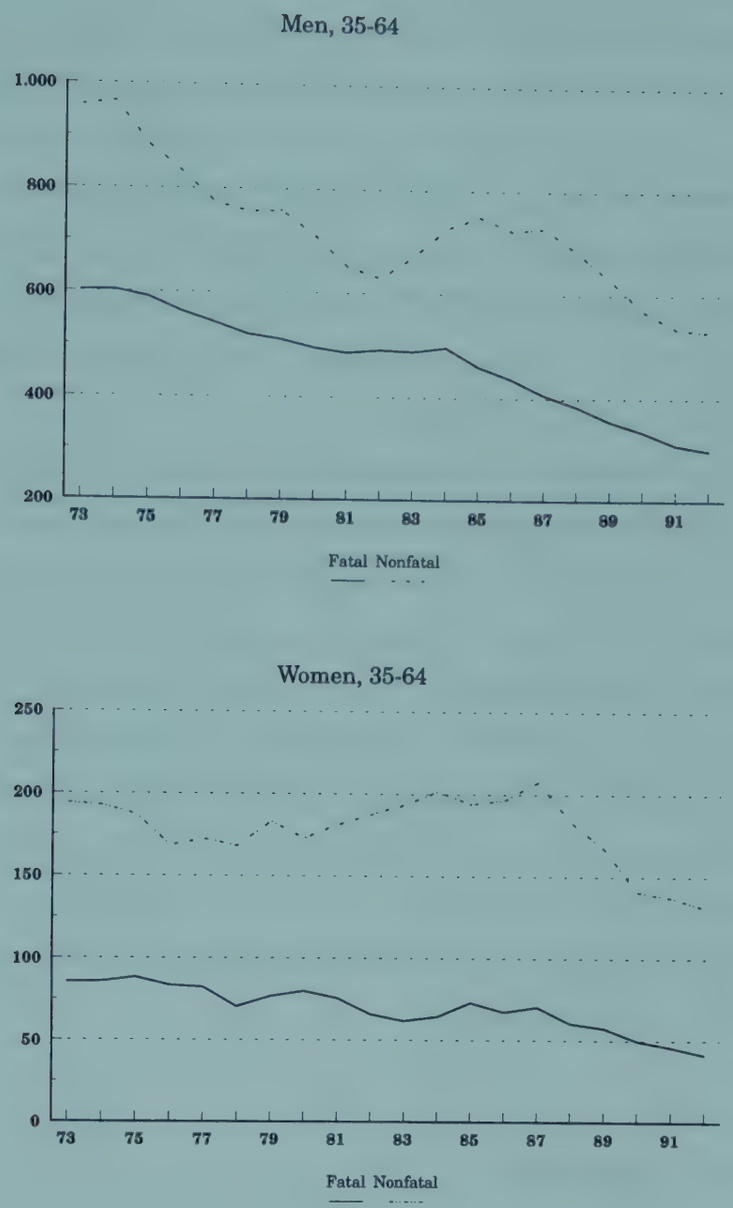

Figure 13.5. Fatal and non-fatal attacks (per 100 000),

4. DISCUSSION

The registraton of suspected AMIs and coronary deaths was a real challenge. Has it been worth all the effort? The answer to emerge from over twenty years experience is a positive one; in the context of a comprehensive and long-lasting preventive undertaking like the North Karelia Project (or the MONICA Project), this kind of registration is feasible. However, an isolated registration programme would perhaps be less meaningful.

The register data support the hypothesis that the official mortality statistics in North Karelia are reliable. Moreover, they allow detailed

study of the trends in mortality from first and recurrent attacks, or from mortality before or after reaching the hospital. Changes in all these parameters can have important consequences for the health care system.

Although the Finnish hospital discharge data are fairly reliable, as Mähönen (1993) has shown, the register data make it possible to go into much more detail, as exemplified above. Being able to perform such detailed analyses is also an instructive experience. It reveals how easily results can be biased by changes in diagnostic criteria, enzyme tests, interpretations of histories and so on. It is thus wise to maintain a critical approach when comparing the non-fatal rates of the 70s and 80s. Despite this proviso, the results still suggest that the non-fatal attack rate declined in the 80s, although slightly less steeply than in the 70s. In addition, the most recent data suggest that the proportion of mild non-fatal attacks seems to have increased compared with the 1970s.

An important aspect of the registration was the links it created between the central hospital (particularly the medical ward) and other activities of the North Karelia Project. This has fostered much support for the hospital doctors and nurses in their preventive efforts. At the same time, the extensive collaboration with other Finnish register centers has proved very profitable.

5. SUMMARY

1. The aim of the AMI Register set up in connection with the North Karelia Project was to assess the longer term trends in coronary mortality, incidence and acute coronary heart attack rates in the province. This chapter presented the results from some twenty years of the register's operations (from 1973 to 1992).

2. From 1973 to 1981 the register used old WHO register criteria, and from 1982 to 1992 the MONICA register criteria. This change of criteria half way through the period biases the analysis, especially that of non-fatal attacks; the impact on the fatal attacks is much smaller.

3. According to the register, the coronary mortality rate declined from 1973 to 1992 by 50 % in men and 48 % in women. The decline in

men aged 35–54 was 64 %; in women aged 55–64 years, whose age adjusted mortality rate was on the same level as in the 35–54 year-old men, the mortality decline was 55 %.

4. The mortality rate from both first and recurrent attacks fell in men and in 55–64 year-old women. In men the decline of mortality from first attack in the 70s was more clear than that from recurrent attacks; in the 80s and early 90s the reverse was true.

5. The pre-hospital mortality and the 28-day mortality after reaching hospital decreased in parallel; towards the end of the period the latter possibly declined even more.

6. In the 70s, the decline in the attack rate (and non-fatal attack rate) mirrored the decline of mortality. From the beginning of the 80s the decline in mortality was steeper than the decline in attack rate.

REFERENCES

Beaglehole R, Stewart AW, Butler M. Comparability of old and new World Health Organization criteria for definite myocardial infarction. Int J Epidemiol 1987;16:373–376.

Mustaniemi H. Äkillisten sepelvaltimotautikohtausten kehityssuunnat Pohjois-Karjalassa 1973–1990. Kuopion yliopiston julkaisuja D. Lääketiede 18. Kuopio 1993.

Mähönen Markku. Poistoilmoitusrekisteri sepelvaltimotaudin epidemiologisen tutkimuksen tietolähteenä. Sairaaloiden poistoilmoitusrekisterin ja FINMONICA-sydäninfarktirekisterin vertailu. Stakes; Tutkimuksia 28. Jyväskylä 1993.

Palomäki P. Sydäninfarkti ja sepelvaltimotautikuolema Kuopion läänissä vuonna 1983. Diagnoosikäytäntö ja epidemiologia. Kuopion yliopiston julkaisuja. Lääketiede. Alkuperäistutkimukset 12/1989.

Salomaa V, Arstila M, Kaarsalo E et al. Trends in incidence and mortality from coronary heart disease in Finland from 1983 to 1988. Am J Epidemiol 1992;136:1303–1315.

Salonen JT, Puska P, Mustaniemi H. Changes in morbidity and mortality during comprehensive community programme to control cardiovascular diseases during 1972–7 in North Karelia. Be Med J 1979;2:1178–1183.

Tunstall-Pedoe H. Problems with criteria and quality control of coronary events in the MONICA study. Acta Med Scand 1988; Suppl 728:17–25.

Tunstall-Pedoe H. Diagnosis, measurement and surveillance of coronary events. Int J Epidemiol 1989;18 (Suppl 1):S169–S173.

Tuomilehto J, Arstila M, Kaarsalo E et al. Acute myocardial infarction (AMI) in Finland - baseline data from the FINMONICA AMI register in 1983–1985. Eur Heart J 1992;13:577–587.

WHO. Ischaemic heart disease registers, Report of the Fifth Working Group (including a second revision of the operating protocol). WHO, Regional Office for Europe, Copenhagen 1971.

WHO. MONICA manual. WHO/CVD Unit, Geneva, 1990.

14. TRENDS IN CEREBROVASCULAR MORTALITY AND INCIDENCE

Cinzia Sarti

Finland is a typical industrialized country in that stroke is the third leading cause of death after heart disease and cancer, and a major cause of long term disability. The Finnish population is aging fast, and stroke is primarily a disease of old people. It is important to explore the trends in the incidence and mortality of stroke in order to generate background information for its control and prevention, and for the efficient planning of health care and social services.

Stroke mortality information based on death certificate diagnoses is obtainable from the Central Statistical Office of Finland (Statistics Finland since 1991), while data on stroke occurrence are available from population-based stroke registries. The information from these sources can also be used to verify the accuracy of routine mortality statistics.

Stroke registration in Finland began in the 1970s. In May 1972 a population-based stroke register was established in North Karelia (Puska et al. 1981) and continued its work until the end of 1991, though in 1982 it was incorporated into the larger FINMONICA stroke register (Tuomilehto et al. 1992).

Stroke registration also took place in an urban area of southern Finland, Espoo-Kauniainen, in 1972–1973 (Aho 1975) and again in 1976–1977 (Kotila 1986), as well as in the city of Kuopio during 1978–1980 (Sivenius et al. 1985). The FINMONICA study was launched in 1982, since when stroke registration has covered Turku/Loimaa in southwestern Finland and the province of Kuopio, in addition to North Karelia.

Mortality from stroke declined steeply in Finland during the 1970s, and this continued during the 1980s (Figure 14.1). Among people aged 30–69 years, i.e. those most prone to so-called preventable deaths, stroke mortality declined by 32.5% (Uemura and Pisa 1988) between 1970 and 1985. In the whole of Finland the overall decline in stroke mortality

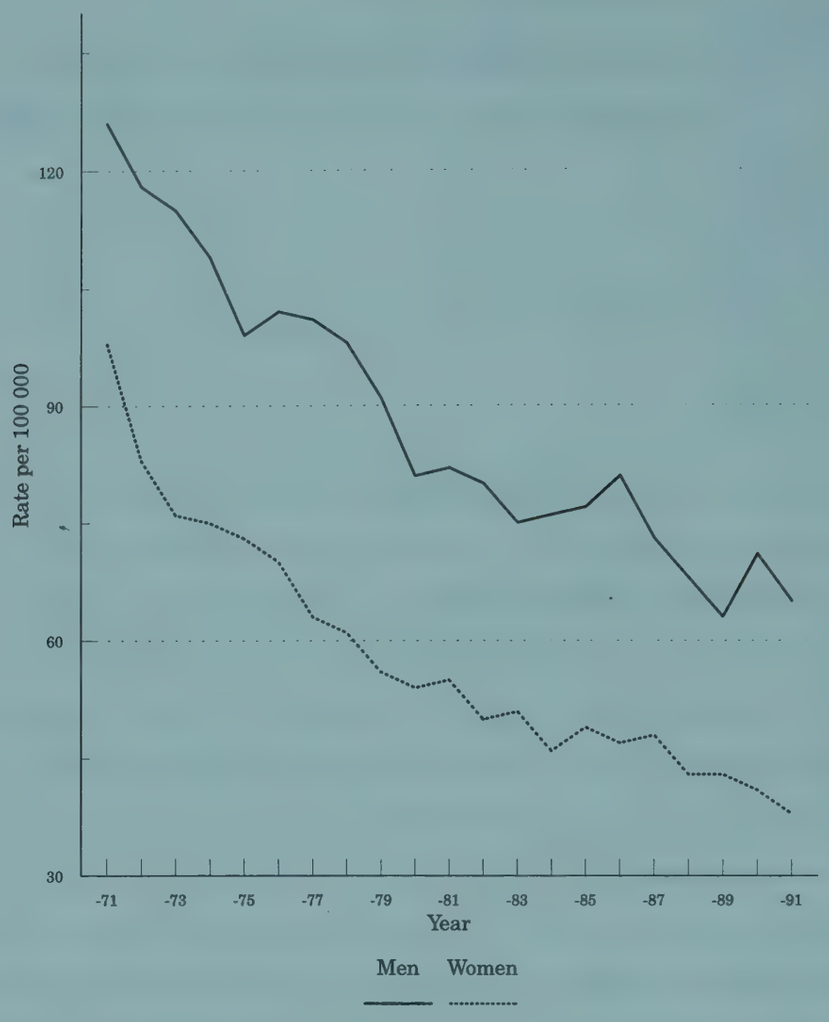

Figure 14.1. Mortality from stroke in Finland according to official mortality statistics, age standardized , age group 25–74.

between 1971 and 1991 varied from 3.2% to 5.6% per year, and was significant in both men and women.

The decline occurred in all the provinces of Finland, but in the 1970s it was particularly evident in those with higher mortality rates from stroke at the start of the decade, such as North Karelia and Kuopio (Table 14.1). In fact, while mortality from stroke was higher in eastern than southwestern Finland 20 years ago, the current rates are similar across the country.

The data from the North Karelian (Table 14.2) and FINMONICA stroke registers (Figure 14.3) confirm the declining trends in stroke mortality observed in official mortality statistics in the 1970s and 1980s. However, unlike stroke mortality, stroke incidence remains higher in eastern compared with southwestern Finland. The register in Kuopio supports this observation for the period 1978–1980 (Sivenius 1985) (Table14.3), and the FINMONICA stroke register gives a similar picture for the 1980s.

	MEN		WOMEN	
PERIOD	ALL FINLAND	NORTH KARELIA AND KUOPIO	ALL FINLAND	NORTH KARELIA AND KUOPIO
1971-1980	-4.1***	-4.7***	-5.5***	-6.2***
1981-1991	-2.2**	-3.2***	-2.8***	-5.4***
1971-1991	-3.2***	-4.0***	-4.0***	-5.2***

Table 14.1. Regression-based change in mortality (%/year) from cerebrovascular disease (ICD-8 and ICD-9 430–438), standardized for age (age group 25–74), according to official mortality statistics, by sex.

	MEN		WOMEN	
PERIOD	INCIDENCE	MORTALITY	INCIDENCE	MORTALITY
1972-1973	328	155	230	114
1982-1983	248	87	141	44
1988-1989	256	80	130	45
% CHANGE BETWEEN 1972-73 AND 1983-89				
	-1.6**	-4.1***	-3.5***	-6.1**

Table 14.2. Age standardized (age group 25–74) incidence and mortality of stroke (ICD-8 430–434, 436)/100000/year in North Karelia, by sex, and their regression-based percentage change between the periods 1972–73 and 1982–1989.

Stroke incidence, as well as mortality, declined during the 1970s in eastern Finland (Table 14.2). In North Karelia, it diminished from 328/100 000/year in 1972–1973 to 248/100 000 in 1982–1983 among men, and from 230 to 141/100 000/year among women. In the Espoo-Kauniainen area of southern Finland (Kotila 1986) the incidence of stroke also declined between 1972–1973 and 1978–1980 (Table 14.3).

Between 1983 and 1989 the incidence of stroke in all Finland declined, according to the FINMONICA stroke register, although not as much as mortality (Figure 14.2 and table 14.2). The average decline in incidence was 1.7% in men and 1.8% in women. Differences between the areas were apparent, but the explanations for this are far from convincing. While practically no decline was observed in North Karelian men after 1982, the largest decrease in stroke incidence in all ages, especially in the oldest registered age group of 65–74 years, was observed in the neighboring province of Kuopio. There was a statistically significant decrease in both the incidence and mortality of subarachnoid hem-

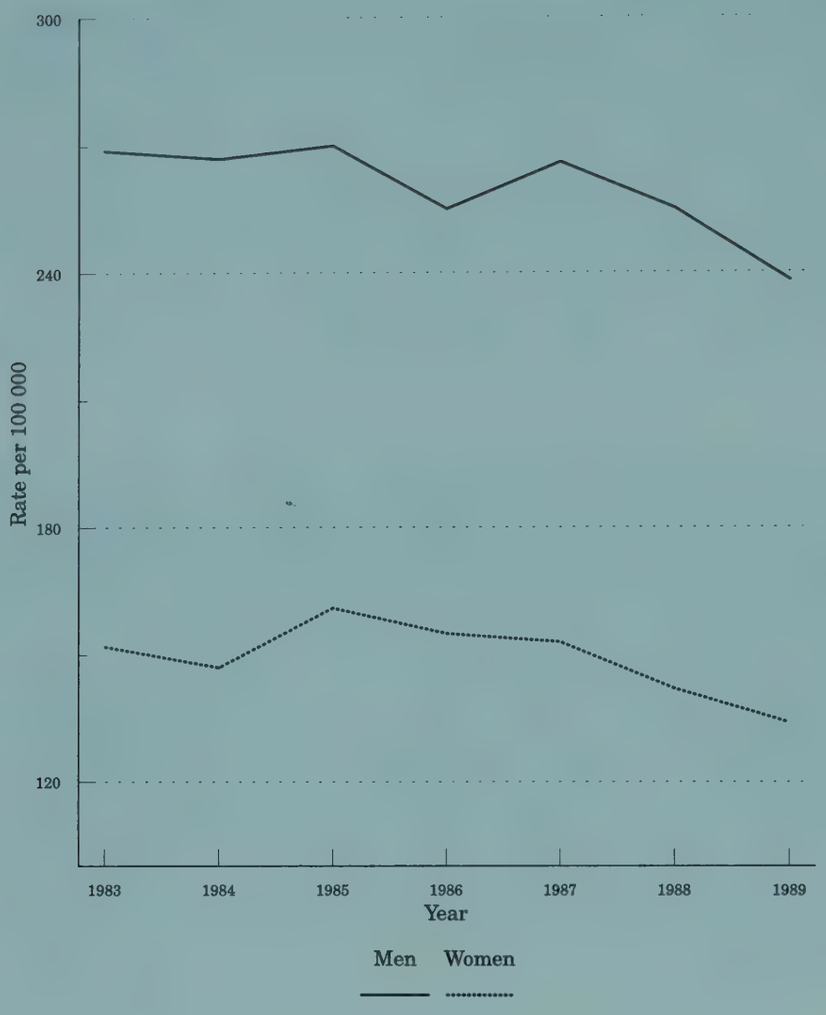

Figure 14.2. Mortality from stroke in FINMONICA during 1983–1989.

orrhage. However, it was the decline in cerebral infarction that accounted for most of the changes, since this subtype of stroke represents about 80% of all stroke in Finland. Finland is the only country in Scandinavia that has reported decreasing trends in stroke incidence during the 1980s.

Early case-fatality (within four weeks of onset of stroke) declined annually during 1983–1989 by 3% ($p < 0.05$) among men and 1.8% (p = n.s.) among women (Figure 14.4). The decline in case fatality from first ever strokes was even larger, by 4.5% yearly ($p < 0.01$) in men and 7.8% ($p = 0.05$) in women.

During the 1980s there was a dramatic increase in the use of computerized tomography in stroke diagnosis (Figure 14.5). This may have biased the stroke incidence trends in a conservative direction and exaggerated the decrease in case-fatality. However, this is unlikely to be the case in the FINMONICA register, where the main criteria for diagnosing stroke are clinical.

	MEN	WOMEN
ESPOO-KAUNIAINEN		
1972-1973[1]	163	104
1978-1980[2]	115	94
KUOPIO		
1978-1980	183	194

[1] Aho 1975
[2] Kotila 1986

Table 14.3. Incidence of stroke in Espoo-Kauniainen in 1972–1973 and 1978–1980, and in Kuopio in 1978–80, by sex, in all ages.

Athough the total number of deaths from stroke has slightly risen over the last 10 years, due to the rapid aging of the Finnish population, mortality from stroke has declined even in the oldest age group (> 75 years), as is evidenced by the FINMONICA data from the city of Turku,

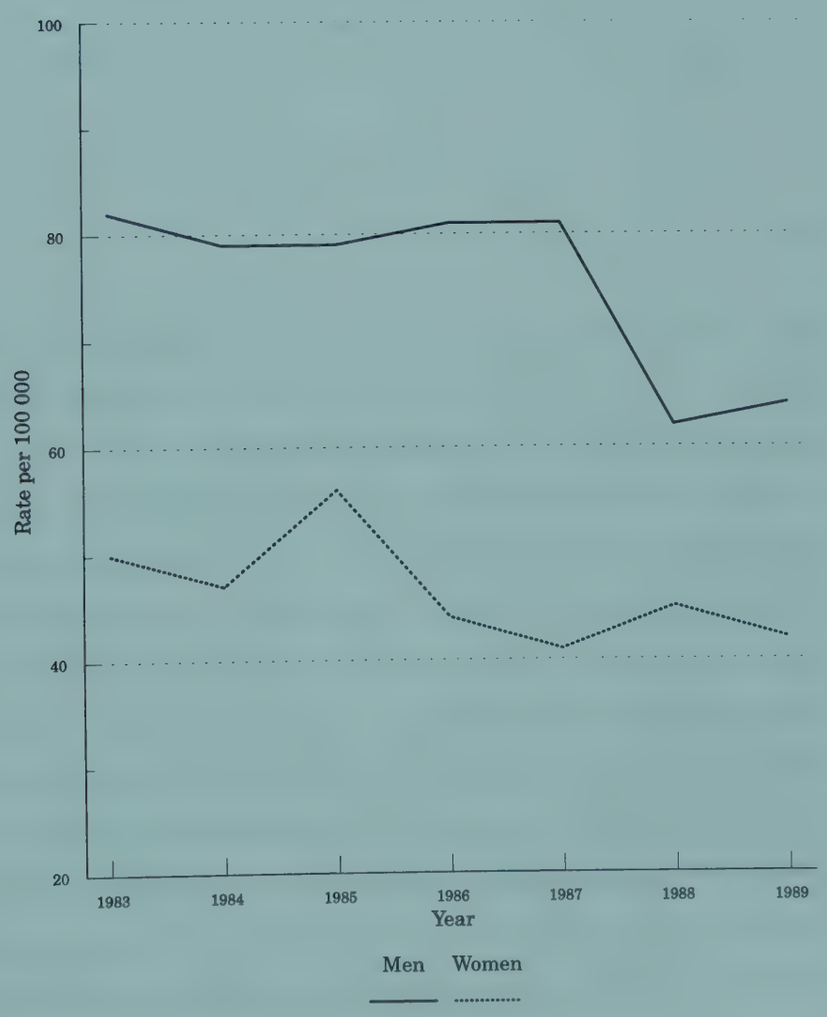

Figure 14.3. Incidence of stroke in FINMONICA during 1983–1989.

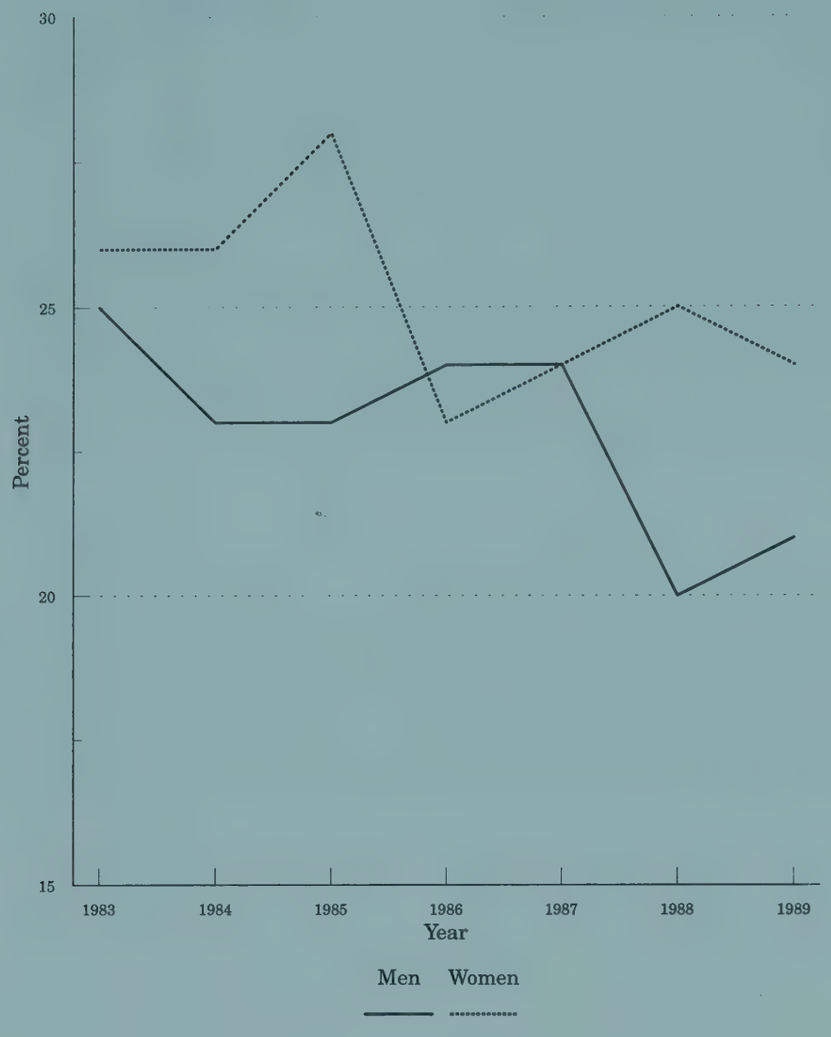

Figure 14.4. Case-fatality of stroke in FINMONICA during 1983–1989.

where all strokes occurring above the age of 25 years are registered: between 1982–1983 and 1987–1988 a decline of 9.4% was detected among men and 23.4% among women.

Despite the data showing progress in the control of this disease, the number of days of hospitalization due to stroke in Finland has risen by about 50% over the last ten years. This can be attributed largely to more hospitalizations of the same patient, partly for diagnostic purposes but mainly for rehabilitation therapy. Patients aged 75 years or more and suffering from cerebral infarction account for almost all of this increase. The finding is not unexpected, since the absolute number of strokes increased in old people, who require longer treatment compared with younger patients. The phenomenon can also be partly explained by the improving availability of rehabilitation resources during the 1980s.

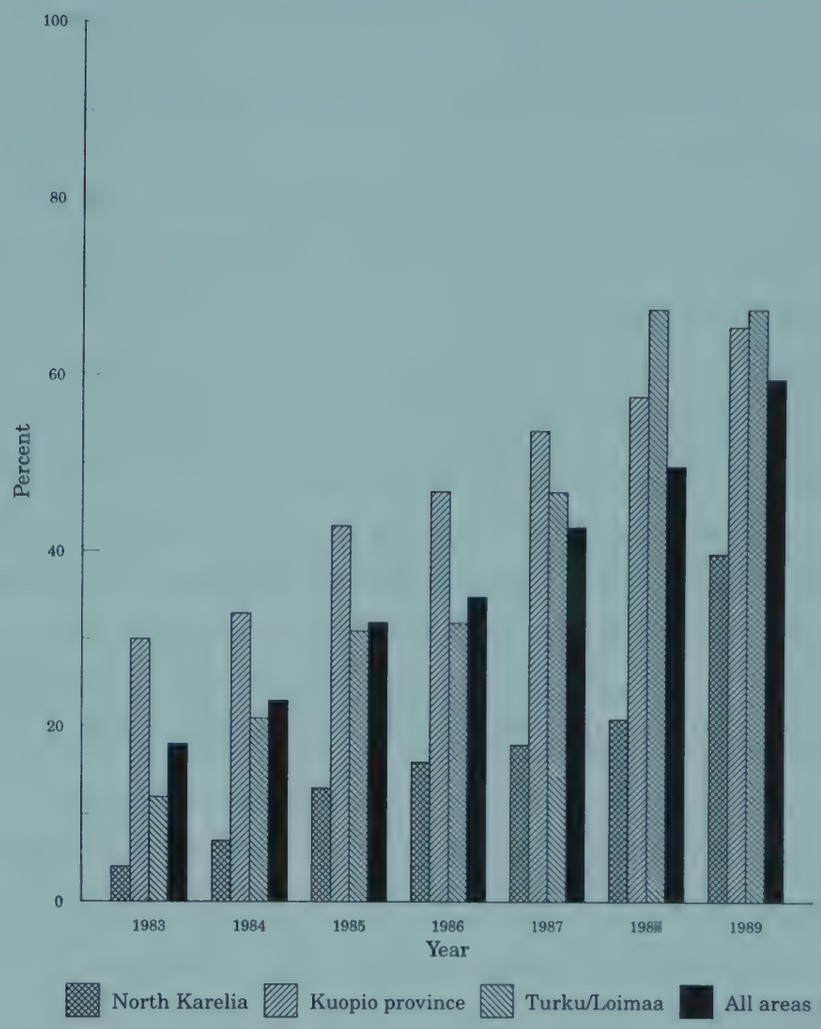

Figure 14.5. Proportion of computerized tomographies performed among stroke cases in FINMONICA during 1983–1986.

The mean duration of hospitalization has decreased over the same period by about four days.

In conclusion, the past two decades have seen important progress in the fight against stroke. Finland, which used to rank very high in stroke mortality and incidence, is now around the middle of the international table, although rates are still far higher than those in Switzerland, for example (among the lowest in the world)(Uemura and Pisa 1988). Fortunately, the improvement appears to be on-going, as indicated by the ever decreasing incidence of stroke. Nevertheless, stroke has swallowed an increasingly large proportion of health care resources over the past 10 years, mainly because of expanded rehabilitation treatment programmes for old people suffering cerebral infarction. Cost-containment measures should therefore target this segment of the population.

REFERENCES

Abo K: Incidence, profile, and early prognosis of stroke. Academic disertation, Helsinki, 1975.

Kotila M: Incidence, case-fatality and outcome of stroke. Academic disseration, Helsinki, 1986.

Puska P, Tuomilehto J, Salonen JT, et al. Community control of cardiovascular diseases – the North Karelia Project: evaluation of a comprehensive community programme for control of cardiovascular diseases in 1972–77 in North Karelia. World Health Organization, Copenhagen, 1981.

Sivenius J, Heinonen OP, Pyörälä K, et al: The incidence of Stroke in the Kuopio area of East Finland. Stroke 1985; 16:188–92.

Tuomilehto J, Sarti C, Narva EV, et al: The FINMONICA stroke register: description of the community based stroke registration and analysis of stroke incidence during 1983 to 1985 in Finland. Am J Epid, 1992; 135: 1259–70.

Uemura and Pisa: Trends in cardiovascular disease mortality in industrialized countries since 1950. WHO Health Stat Q 1988; 41:155–78.

15. CVD AND OTHER DISABILITY

Urpo Kiiskinen

1. INTRODUCTION

Over the twenty years following 1972, the rate of cardiovascular diseases as cause of disability pensions in Finland declined from first to third place, after musculoskeletal diseases and mental disorders.

Finland operates a comprehensive disability pension scheme; everyone is insured and the system is operated by the Social Insurance Institution (SII). When a person is assessed as unable to work before his/her retirement pension is due (generally at 65 years), the attending doctor writes a certificate. The process of assessment is carefully regulated, and the final decision is made by the SII. The purpose of this is to ensure that the same criteria are applied throughout the country.

Disability pension has become far more common in recent years. According to the official SII statistics (Kansaneläkelaitos, 1993) persons receiving disability pension totalled 180 000 at the end of 1972 and over 270 000 at the end of 1992. However, over the same period the number of disability pensions due to the cardiovascular diseases (CVD) declined from 53 000 to 40 000 (Table 15.1).

Statistical material from the SII (Kansaneläkelaitos, 1993) and Statistics Finland (Tilastokeskus, 1993) were used to calculate annual prevalence rates of CVD disability among men and women aged 35 to 64 in North Karelia and the whole country. Rates were age-standardized using the 1972–1992 mean population.

	CVD DISABILITY PENSIONS		ALL DISABILITY PENSIONS	
	NORTH KARELIA	ALL FINLAND	NORTH KARELIA	ALL FINLAND
Men				
1972	2 286	29 663	6 504	95 283
1977	2 256	34 600	6 934	115 246
1982	1 729	28 795	6 047	109 108
1987	1 518	28 174	6 462	124 651
1992	1 453	26 763	7 067	142 741
Women				
1972	1 516	23 109	5 346	88 138
1977	1 716	28 454	6 387	114 029
1982	1 076	19 735	5 287	101 799
1987	732	15 637	5 420	113 442
1992	599	13 312	5 680	128 919

Table 15.1. The number of people on disability pensions on 31st December each year.

2. RESULTS

Figure 15.1 presents the trends in age-standardized annual prevalence rates of disability pensions for men from 1971 to 1992. The figure reveals that the CVD disability rate for North Karelia has exceeded that for the whole country over the entire study period. In the early 70s the rates for both areas were rising. Thereafter the upward trend in North Karelia flattened out and began falling earlier, so the rates started to approach each other. The clear decrease in both from the mid-70s to the mid-80s has since levelled off, and the difference between North Karelia and all Finland has remained fairly constant.

The relative reduction from 1972 to 1992 was 41.2% for North Karelia, compared to only 24.6% for the whole country. These figures indicate that the regional differences have diminished markedly over the twenty years.

In men, the development in the age-standardized prevalence rates of all disability pensions was quite similar to that of CVD disability rates until the mid 1980s. From 1985 there was a clear upturn in all cause disability pension rates in both North Karelia and all Finland, and this continued until the end of the study period. The rates of all disability pensions in North Karelia and in all Finland also began to approach

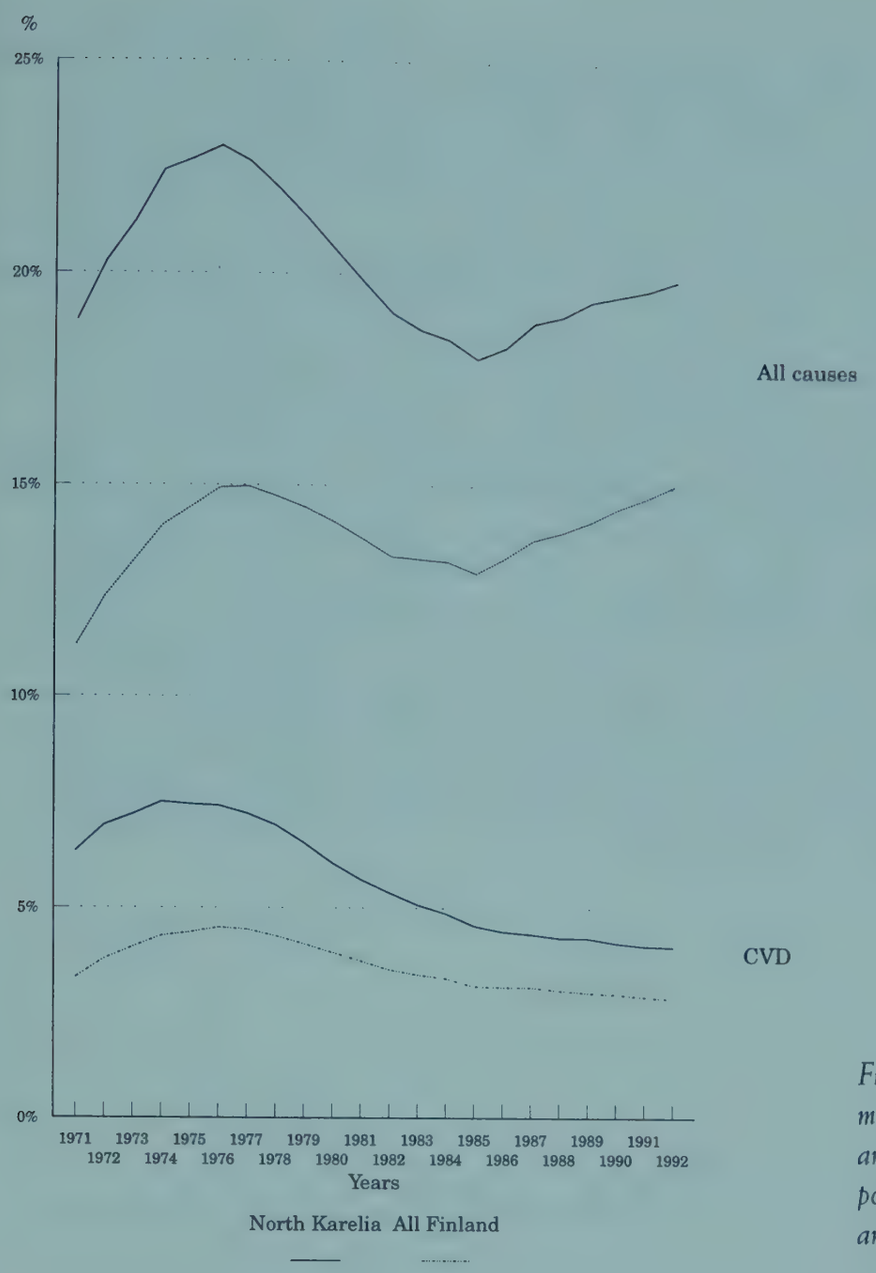

Figure 15.1. Proportion of men on disability pension among the 35–64 year old population in North Karelia and in all Finland.

each other, although proportionally much less than in the case of CVD disability rates.

The trends in disability pension rates among women were very similar (Figure 15.2). The main distinctions were that the initial difference in CVD disability rates between North Karelia and all Finland was somewhat smaller and the decline in rates greater than among the men. As a result of the steep decline in North Karelia since 1975 the rate is now only slightly above the national average.

The relative fall from 1972 to 1992 in CVD disability rates was more dramatic among women than men. The statistics show a decline of 59.1% for North Karelia and 43.0% for the whole country.

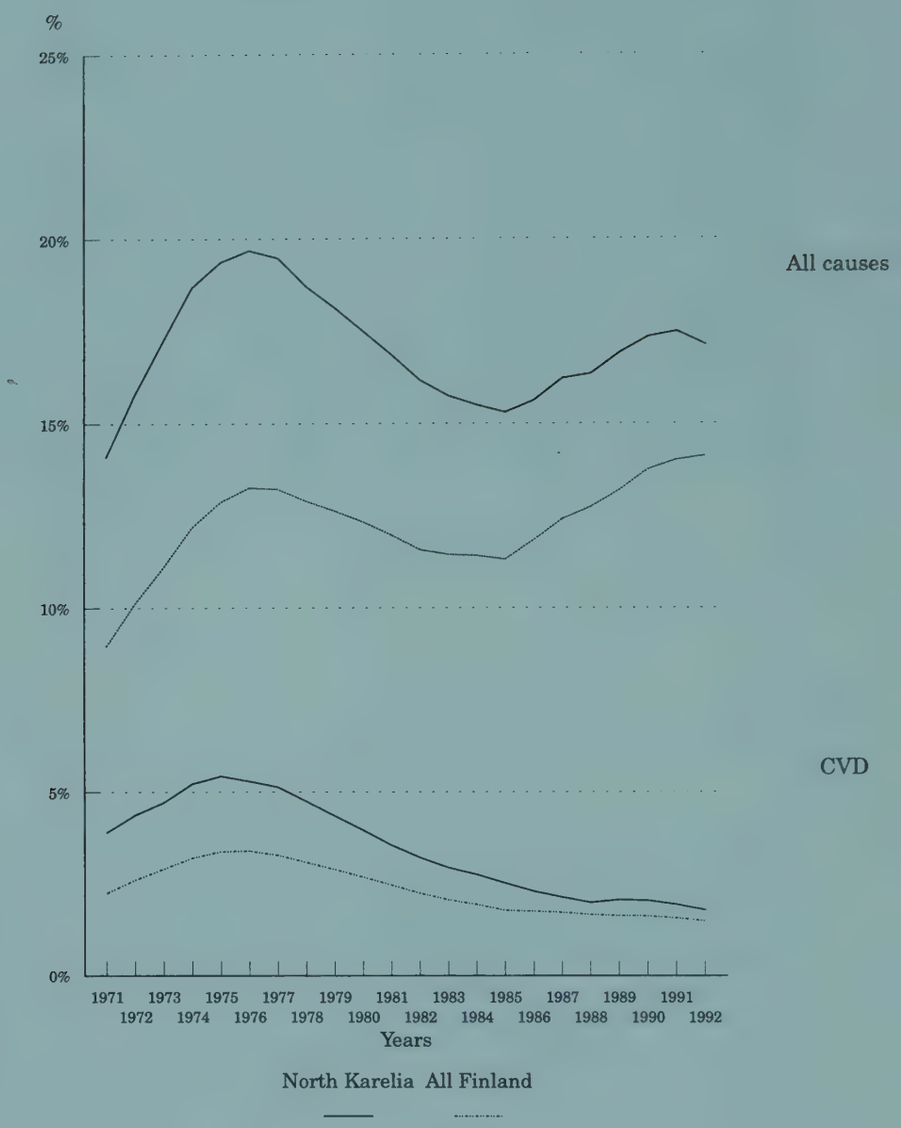

Figure 15.2. Proportion of women on disability pension among the 35–64 year old population in North Karelia and in all Finland.

Table 15.2 presents the change in CVD disability rates by sex and age group as a percentage of the 1972 figures. Table 15.2 shows that in twenty years the rates for the two oldest age groups in both genders have clearly improved more in North Karelia than in all Finland. The first ten-year changes were generally more favourable in North Karelia; only the average decline among 35–49 year-old men in all Finland was comparable with the change in North Karelia.

3. DISCUSSION

The wide cyclic fluctuations in the overall rates for all disability pensions have been explained by factors such as changes in the level and

	35 – 49		50 – 54		55 – 59		60 – 64	
	NORTH KARELIA	ALL FINLAND	NORTH KARELIA	ALL FINLAND	NORTH KARELIA	ALL FINLAND	NORTH KARELIA	ALL FINLAND
Men								
Rate in 1972	1.89 %	0.92 %	8.79 %	4.13 %	14.92 %	7.28 %	20.62 %	12.90 %
Change from 1972								
1977	-4.9 %	-4.1 %	-1.8 %	23.1 %	-5.9 %	24.9 %	10.7 %	19.4 %
1982	-48.1 %	-48.7 %	-34.5%	-18.4 %	-19.7 %	0.5 %	-9.9 %	5.1%
1987	-64.7 %	-57.5 %	-47.0 %	-34.7 %	-36.1 %	-11.5 %	-22.7 %	-3.9 %
1992	-63.2 %	-61.0 %	-57.3 %	-46.9 %	-34.5 %	-15.3 %	-30.3 %	-10.9 %
Women								
Rate in 1972	0.73 %	0.38 %	3.58 %	2.07 %	9.05 %	4.77 %	13.80 %	9.10 %
Change from 1972								
1977	-12.9 %	8.0 %	11.5 %	19.0 %	7.1 %	27.7 %	31.9 %	28.7 %
1982	-58.9 %	-49.3 %	-36.8 %	-29.0 %	-39.4 %	-19.5 %	-9.7 %	-3.3 %
1987	-69.3 %	-63.6 %	-64.1 %	-49.2 %	-54.1 %	-32.0 %	-43.3 %	-28.1 %
1992	-78.7 %	-69.4 %	-68.8 %	-65.7 %	-61.5 %	-38.4 %	-51.9 %	-36.7 %

Table 15.2. CVD disability pensions. Prevalence rates in 1972 and cumulative changes (%) from 1972 rates by age-group and gender in North Karelia and all Finland in five-year intervals.

structure of disability benefits offered by the SII, in the employment structure nationwide, in the overall state of the national economy, in attitudes, and in morbidity (Hytti, 1992). Thus the developments in the disability pension rates described here are not necessarily caused by changes in morbidity alone.

Nonetheless, the decline in CVD disability rates has contrasted with the upswing in all disability pension rates since 1985. Since it can be assumed that the above-mentioned economic and social factors would have equal impact on disability pension rates regardless of the type of disease, it seems evident that the continued fall in CVD disability rates has been primarily caused by the decreasing CVD morbidity. This conclusion is supported by the findings of the most recent studies on trends in coronary risk factors and mortality (e.g. Vartiainen et al., 1994).

When reviewing the developments by age groups we need to bear in mind that the relative changes in prevalence rates in the older age-groups have greater significance – in terms of absolute numbers of per-

sons on disability pension – than those in younger age groups. However, the extent of the proportional change in the younger age groups, especially among women, is highly impressive and likely to manifest itself better in the coming decades.

On the basis of these results, it can be concluded that the overall changes in both CVD disability and all disability pensions have been more favourable in North Karelia than all Finland on average during the 20-year follow-up period. This has also meant considerable economic savings to the SII, and thus ultimately to the tax payers who finance the system. Another result of this development is that the regional differences in CVD disability rates have narrowed. It is also worth noting that the reduction in CVD disability has also been remarkable for all Finland, especially compared to the developments in overall disability rates.

REFERENCES

Hytti H 1992. Työkyvyttömyyseläkkeiden alkavuuden yhteiskunnalliset taustatekijät. Sosiologian lisensiaattitutkimus. Helsingin yliopisto 1992.

Kansaneläkelaitos 1993 (Social Insurance Institution). Unpublished data on disability pensions provided by the Social Insurance Institution.

Tilastokeskus 1993 (Statistics Finland). Population statistics 1972–1992.

Vartiainen E, Puska P, Jousilahti J, Korhonen HJ, Tuomilehto J, Nissinen A 1994. Twenty-year Trends in Coronary Risk Factors in North Karelia and other areas of Finland. International Journal of Epidemiology, Vol. 23, No. 3, 495–504.

16. OTHER MORBIDITY AND GENERAL HEALTH

Sami Heistaro, Erkki Vartiainen and Pekka Puska

1. INTRODUCTION

While accumulating information on the primary coronary disease risk factors, the North Karelia Project also gathered data on socioeconomic and psychosocial factors, medical history, health behaviour and perceived health status.

Physicians' ratings provide an objective measure of health, though they are not necessarily the most accurate estimates of the extent to which a person's condition is painful and debilitating (Larson 1978). The same study found that of all the elements of an older person's life situation, health is the one most strongly related to subjective well-being. Self-rated health was second only to age in its power to predict early mortality among a group of people over 65 years of age (Mossey 1982).

Musculoskeletal complaints such as back and joint pain nowadays constitute a major public health problem. Each month, two-thirds of Finnish adults suffer musculoskeletal pain (Aromaa 1989), and about 80 per cent of the population will experience low back pain sometime during life (Tsang 1993). Musculoskeletal disorders are now the most prevalent group of chronic diseases in the Finnish adult population (Sievers 1991). Between 1976 and 1987, most of the increase in overall long-term morbidity and disability in Finland was due to the rapid rise in musculoskeletal and connective tissue diseases (Kalimo 1992). Musculoskeletal disorders are also of considerable economic concern in Finland; the proportion of early pensions for which they were cited as the main cause rose from 16 % in 1976 to 25 % in 1985 (Slätis 1991).

There is a range of perceived symptoms in the general population whose occurence has received little attention; these include swelling of the lower limbs, varicose veins, constipation, and recurrent stomach com-

plaints. However, the fact that they are rather common symptoms (Thompson 1980) or causes of disorder renders them worthy of study.

The prevalence of psychosomatic symptoms in the Finnish population is an another area lacking adequate monitoring and research. Some workers in the field even claim that psychosomatics should form the basis of all medical deliberations and action (Anthenien 1991).

Perceived health status and symptoms form a challenging research theme in many ways, and several of the issues involved have received little intensive study. The North Karelia Project data provided us with the interesting opportunity to assess perceived health trends over a 20-year period throughout Finland, and particularly in North Karelia where an active community programme to reduce CVD risk factors started in 1972.

2. MATERIAL AND METHODS

Comparable cross-sectional population studies were carried out every fifth year in the provinces of North Karelia and Kuopio, beginning in 1972. The reference area in southwestern Finland was incorporated in 1982; it included the city of Turku, the small town of Loimaa and 12 nearby rural municipalities. An independent random sample was drawn from the population register for each survey. The survey methods, as well as the sample sizes and participation rates, are presented in Chapter 4.

The surveys were initiated by mailing to the subjects a questionnaire plus an invitation to a free health examination at their local health center. Several questions concerning perceived health status were included in the questionnaire, which had precoded response choices. The survey respondents filled in the questionnaire at home, but it was checked by a nurse at the examination. Several studies support the view that a person's perceived health status tends to be realistic (LaRue 1979, Hunt 1980, Halabi 1992). Maddox (1973) states that self-reports of health are feasible for surveys of large populations. In a Finnish study (Koivukangas 1992), there were no significant differences in the results obtained by a postal questionnaire and a face-to-face interview using the Nottingham Health Profile (Hunt 1981, Hunt 1989). Questionnaire and interview are, in fact, the only available methods for gathering informa-

tion on symptoms and perceived health, and are often the most efficient ways of collecting data on the population's health (LaRue 1979, Aromaa 1986).

In the questionnaire the subjects were asked to rate their present health status on a five-point scale: very good – rather good – mediocre – rather poor – very poor. Despite its simplicity, this kind of estimate has, in some studies, predicted the development of health status even better than a physician's prognosis (Maddox 1973). A question with four or five alternatives estimating the respondent's perceived health status has been used in several health surveys (Maddox 1973, Tornstam 1975, LaRue 1979, Jylhä 1982, Mossey 1982, Aromaa 1989, Schroll 1991, Suominen 1993, Zung 1993).

The prevalence of several physical symptoms and complaints during the preceding month was assessed by the questionnaire. The subjects were asked if they had had joint pain, back pain or back ache, swelling in the lower limbs, varicose veins, constipation or recurrent stomach complaints during the past 30 days. The options were 'yes' and 'no'.

There were also 13 different psychosomatic symptoms presented to the respondents. They were asked how often each symptom had been apparent or had bothered them during the preceding month. There were three alternatives: 'often', 'sometimes' and 'not at all'. The symptoms were accelerated heart beat, getting confused when doing a task quickly, trembling hands, excitedness and nervousness, frightening thoughts, exhaustion and overstrain, irregular heart beats, vertigo, nightmares, depression, sleeplessness, headache, and sweating hands. We assessed these psychosomatic symptoms as a summed score and calculated the means of the sums of the 13 symptoms by sex, year and area. The alternative "often" received the value 2, "sometimes" 1, and "not at all" 0. We substituted '0' for missing values if at least one of these 13 questions had been answered; in most of such cases it really meant that these symptoms had not occurred. This type of sum scoring has been used in earlier Finnish studies (Paronen 1982, Rimpelä 1982).

We calculated statistical significances using the Chi-Square test in two-dimensional cross-tabulations, and the loglinear model in multidimensional cross-tabulations.

3. RESULTS

3.1. PERCEIVED HEALTH STATUS

The proportion of men and women estimating their health status as very good or rather good rose over the 20-year period in all the areas (Tables 16.1A and 16.1B). The change in perceived health status between 1972 and 1992 in five classes from very good to very poor was statistically significant ($p<0.001$) for both sexes in North Karelia and Kuopio provinces, as was the overall change for the period in the two areas combined according to the loglinear model ($p<0.001$). The change over the ten-year period from 1982 to 1992 in the three areas together was statistically significant for both sexes ($p<0.01$ for men and $p<0.001$ for women). The development in North Karelia and Kuopio was fairly similar over the 20-year period, although during the first ten years (1972–82) subjective health improved somewhat more in North Karelia than Kuopio.

%	1972	1977	1982	1987	1992
NORTH KARELIA (*)					
VERY GOOD	6	7	9	10	11
RATHER GOOD	26	32	36	35	39
MEDIOCRE	43	44	42	42	38
RATHER POOR	22	16	12	12	12
VERY POOR	4	2	1	1	0
KUOPIO PROVINCE (*)					
VERY GOOD	7	7	9	9	12
RATHER GOOD	28	35	36	39	38
MEDIOCRE	43	43	43	42	41
RATHER POOR	19	13	12	10	8
VERY POOR	3	1	1	1	1
SOUTHWESTERN FINLAND (NS)					
VERY GOOD			9	10	12
RATHER GOOD			37	43	39
MEDIOCRE			43	38	40
RATHER POOR			10	8	7
VERY POOR			1	1	1

Statistical significance for the twenty-year trend in North Karelia and Kuopio and for the ten-year trend in Southwestern Finland; Chi-Square: (*) = $p<0.001$, (ns) = statistically not significant.

Table 16.1A. Preceived health status among men aged 30 to 59 years, by year and area.

%	1972	1977	1982	1987	1992
NORTH KARELIA (*)					
VERY GOOD	3	6	10	10	13
RATHER GOOD	28	35	42	41	46
MEDIOCRE	45	44	39	40	34
RATHER POOR	20	14	9	8	6
VERY POOR	3	1	1	1	0
KUOPIO PROVINCE (*)					
VERY GOOD	5	5	9	12	14
RATHER GOOD	29	37	41	40	46
MEDIOCRE	46	45	41	39	32
RATHER POOR	17	12	9	8	7
VERY POOR	2	1	1	0	1
SOUTHWESTERN FINLAND (NS)					
VERY GOOD			11	10	15
RATHER GOOD			44	47	43
MEDIOCRE			37	36	33
RATHER POOR			7	7	7
VERY POOR			1	0	1

Statistical significance for the twenty-year trend in North Karelia and Kuopio and for the ten-year trend in Southwestern Finland; Chi-Square: (*) = $p<0.001$, (ns) = statistically not significant.

Table 16.1B. Preceived health status among women aged 30 to 59 years, by year and area.

3.2. Perceived symptoms and complaints

The results concerning the six physical symptoms are presented in Tables 16.2A and 16.2B for men and women separately.

Joint pain and back pain

The prevalence of joint pain during the previous month did not change much in either eastern province, except that in Kuopio men there was a significant increase from 23 % in 1972 to 29 % in 1992 ($p<0.01$) which rendered the difference between the developments in the two provinces statistically significant ($p<0.05$) by the loglinear model. Among women in southwestern Finland there was a slight increase in joint pain prevalence from 1982 to 1992 ($p<0.05$).

The prevalence of back pain during the previous 30 days fell markedly in North Karelia over the two decades ($p<0.01$ for men and $p<0.01$ for women). Among men in Kuopio, where the initial prevalence was lower than in North Karelia, no significant change was observed. Among Kuopio women there was a rising level of back complaints from 1972 to 1977, which thereafter returned to its original level. In 1992, almost half of the population in eastern Finland aged 30 to 59 years suffered from back complaints. The proportion was somewhat lower in southwestern Finland.

Swelling in lower limbs and varicose veins

Swelling in the lower limbs is predominantly a women's problem. About a fourth of the women in all three areas throughout the follow-up period reported having this complaint during the month preceding the survey, compared with less than 10 % of the men.

Over the 20-year period there was a significant ($p<0.001$) decline in the prevalence of varicose veins among women in North Karelia and Kuopio. The rates fell from 37 % to 27 % in North Karelia and from 32 % to 22 % in Kuopio. Again, this symptom was much less common among men: only 6–8 % of men reported varicose veins over the period 1972–1992.

Constipation and recurrent stomach complaints

Among men, the prevalence of constipation remained more or less stable from 1972 to 1992, whereas women experienced a rising trend in both North Karelia ($p<0.01$) and Kuopio ($p<0.001$). Developments in southwestern and eastern Finland were similar from 1982 to 1992.

From 1972–82 there was a continuous decline in recurrent stomach complaints during the previous month in North Karelia and Kuopio. The change among men then levelled off while the prevalence increased again in women, almost to the 1972 levels.

%	1972	1977	1982	1987	1992
NORTH KARELIA					
JOINT PAIN	27	28	28	27	27(ns)
BACK PAIN OR BACK ACHE	54	53	50	48	46(**)
SWELLING IN LOWER LIMBS	7	5	4	6	9(***)
VARICOSE VEINS	8	7	6	7	7(ns)
CONSTIPATION	10	9	8	9	10(ns)
RECURRENT STOMACH COMPLAINTS	25	18	15	15	16(***)
KUOPIO PROVINCE					
JOINT PAIN	23	24	25	28	29(**)
BACK PAIN OR BACK ACHE	47	47	49	46	46(ns)
SWELLING IN LOWER LIMBS	5	5	4	3	8(**)
VARICOSE VEINS	7	7	6	7	8(ns)
CONSTIPATION	6	7	8	6	8(ns)
RECURRENT STOMACH COMPLAINTS	21	18	14	16	15(***)
SOUTHWESTERN FINLAND					
JOINT PAIN			22	21	24(ns)
BACK PAIN OR BACK ACHE			39	41	39(ns)
SWELLING IN LOWER LIMBS			6	5	7(ns)
VARICOSE VEINS			7	7	6(ns)
CONSTIPATION			6	6	8(ns)
RECURRENT STOMACH COMPLAINTS			14	15	15(ns)

Statistical significance for the twenty-year trend in North Karelia and Kuopio and for the ten-year trend in Southwestern Finland; (***) = p<0.001, (**) = p<0.01, (*) = p<0.05, (ns) = statistically not significant.

Table 16.2A. Somatic symptoms and complaints perceived during the preceding 30 days among men aged 30 to 59 years, by year and area.

%	1972	1977	1982	1987	1992
NORTH KARELIA					
JOINT PAIN	34	33	33	33	32(ns)
BACK PAIN OR BACK ACHE	53	51	46	50	49(**)
SWELLING IN LOWER LIMBS	28	27	25	22	25(***)
VARICOSE VEINS	37	32	27	22	27(***)
CONSTIPATION	14	15	16	16	20(**)
RECURRENT STOMACH COMPLAINTS	24	20	17	17	22(***)
KUOPIO PROVINCE					
JOINT PAIN	29	30	29	31	34(ns)
BACK PAIN OR BACK ACHE	47	51	46	46	48(**)
SWELLING IN LOWER LIMBS	26	29	26	26	25(*)
VARICOSE VEINS	32	31	26	26	22(***)
CONSTIPATION	12	16	17	18	21(***)
RECURRENT STOMACH COMPLAINTS	21	18	15	18	20(**)
SOUTHWESTERN FINLAND					
JOINT PAIN			22	23	28(*)
BACK PAIN OR BACK ACHE			42	40	42(ns)
SWELLING IN LOWER LIMBS			23	31	24(**)
VARICOSE VEINS			21	18	19(ns)
CONSTIPATION			18	19	19(ns)
RECURRENT STOMACH COMPLAINTS			15	15	20(*)

Statistical significance for the twenty-year trend in North Karelia and Kuopio and for the ten-year trend in Southwestern Finland; (***) = p<0.001, (**) = p<0.01, (*) = p<0.05, (ns) = statistically not significant.

Table 16.2B. Somatic symptoms and complaints perceived during the preceding 30 days among women aged 30 to 59 years, by year and area.

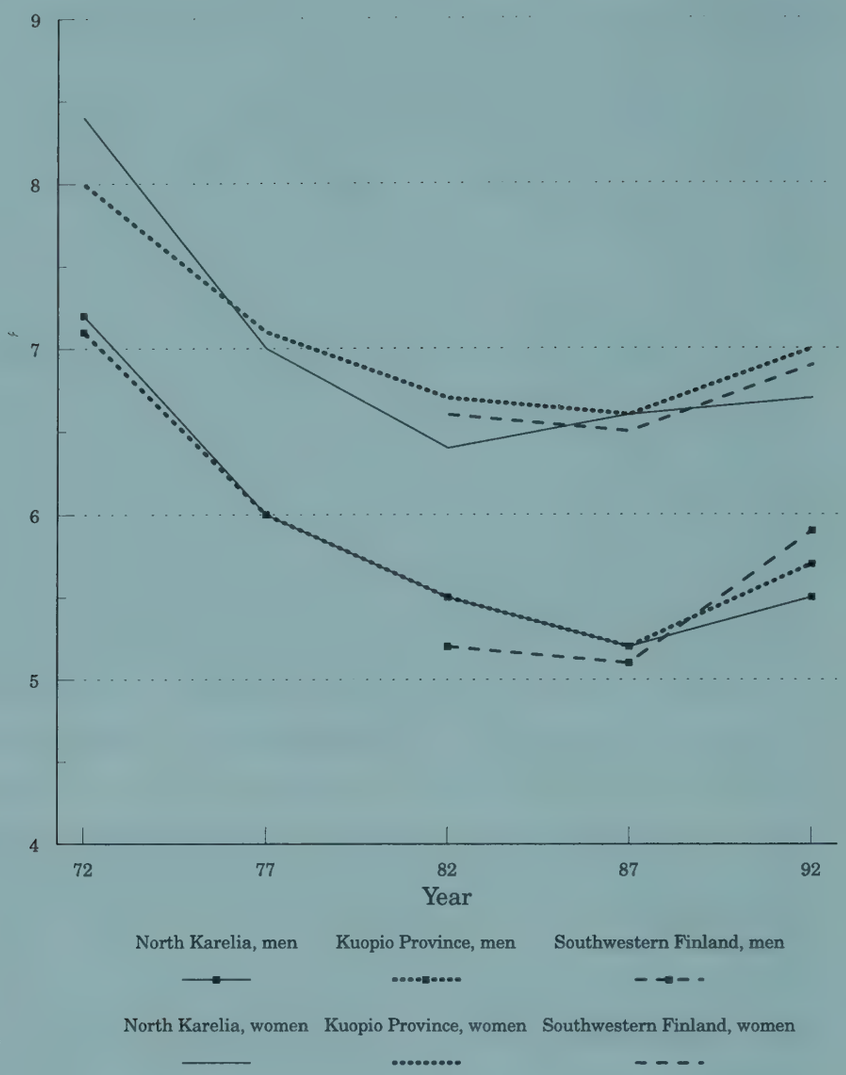

Figure 16.1. The values are means of the sums of 13 perceived symptoms (see text).

3.3. Psychosomatic symptoms

The psychosomatic symptoms most commonly reported were excitedness and nervousness, exhaustion and headache. Assessed by the summed score, the psychosomatic symptoms were slightly more common among females than males (Figure 16.1). The developments in all three areas were very alike; the decline in symptom prevalence which began in 1972 ceased after 1987, and by 1992 the rates were again higher than in 1987. The symptoms mainly responsible for the latter increase were frightening thoughts, nightmares, depression and sleeplessness among men, and nightmares and sleeplessness among women.

4. DISCUSSION

There seems to have been a clear improvement in perceived general health status in both sexes during the follow-up period. In 1972 and 1977 there were no significant differences between men and women in eastern Finland. In 1992, however, women in all three areas tended to evaluate their health as better than men: about 60 % of women reported their health as very good or rather good, compared with about 50 % of men. This female advantage is an enigma.

In the Mini-Finland Health Survey (Aromaa 1989), men and women estimated their health status very similarly and no significant difference between the sexes was found. The concept of good health may be different between the genders. In a Finnish study (Kumpusalo 1992), men tended to associate their general health with physical functioning, whereas women tended to rank it more on the basis of perceived symptoms.

Reliance on self-rated health alone as an indicator of objective health status may be inappropriate (Tissue 1972, Mossey 1982). Tissue (1972) has assessed the various dimensions of perceived health. Subjective criteria for good health may vary between individuals in different age groups, for example (Tornstam 1975, Cockerham 1983, Johnson 1993), though in the present report the variation between age groups was not assessed. Individuals tend to overestimate rather than underestimate their health (Maddox 1973, LaRue 1979). The idea of what a good health status actually means may also vary with time. Improvements in primary health care could have changed people's expectations of what a good health status should be.

Despite the possible biases, our data provide a good view of the positive change in perceived global health status in North Karelia, Kuopio and southwestern Finland during the follow-up period. One goal for further research would be to compare perceived health trends with those in the use of health services. What will be the effect of the current high unemployment rates in Finland on perceived health? Many such crucial questions demand continuous monitoring and study.

Agreement between medical and interview or questionnaire information is particularly good for well-known, severe, long-term or disabling somatic disorders (Aromaa 1986). Of the symptoms being assessed

here, each is well-known but does not necessarily fulfil these other conditions. Nevertheless, the questions have been presented in exactly the same form over the 20-year period.

Women suffer from swelling in lower limbs, varicose veins and constipation noticeably more often than men, but for the other perceived somatic symptoms the sex differences are less pronounced. Contrary to the findings of a survey conducted in Finland in 1987 (Kalimo 1992), our data do not reveal a growing trend in the prevalence of musculoskeletal disorders. If our data are accurate, the results fail to explain the increasing number of disability pensions due to musculoskeletal disorders (Slätis 1991). Nevertheless, the prevalence of back pain during the past month – about 50 % among the middle-aged population of eastern Finland – is very high and a real health problem for working-age people.

In the last few years, smoking has been connected with back disorders (Frymoer 1983, Battie 1991, O'Connor 1993), although the relationship is not entirely undisputed (Symmons 1991). Boshuizen et al. (1993) observed a relationship between smoking and back pain only in occupations that require physical exertion. The present results do not permit us to comment on whether reduction of male smoking had anything to do with the observed reduction in back pain symptoms in North Karelia.

The prevalence of varicose veins diminished markedly among women in both eastern provinces from 1972 to 1992. The lower morbidity from cardiovascular diseases may have influenced these symptoms. The reduction in obesity of women during the follow-up may also be a contributor. Improvements in the surgical treatment of varicose veins may have an effect,too.

Psychosomatic symptoms are more of a female problem (Aro 1982, Aromaa 1989). Possible explanations for the gender difference are that females more openly express their symptoms, or are stressed about family as well as work (Tibblin 1990). Trembling and sweating hands were the only symptoms slightly more common among males in 1992.

Assessing developments in subjective health and general symptoms is naturally of great interest in the context of overall evaluation in the North Karelia Project. Were the intensive risk factor/lifestyle interventions and/or changes associated with developments in general health? While it is easy to speculate that changes in the risk factors and lifestyles

targeted in the project could have generally positive health effects, many people have expressed concern about the potential harmful emotional consequences of intensive risk factor measurement and interventions.

The findings clearly support the view that when there are positive changes in risk factors and health behaviour, the general health of the population also develops favourably. By some indicators the improvement in North Karelia was better than in Kuopio. In a previous paper we reported that the trends in psychosomatic/emotional symptoms in North Karelia were more favourable than in Kuopio in 1972–82 (Kottke et al. 1984). We argued that a practical service-oriented community programme – perhaps because of its practical nature and the enhanced social support – may lead to a lower prevalence of emotional or psychosocial problems.

5. SUMMARY

General perceived health status improved markedly in both sexes – especially among women – during the follow-up in North Karelia and Kuopio. In 1992, about 50 % of men and 60 % of women reported their health as very good or rather good. Back pain among North Karelian men decreased from 54 % to 46 % over the twenty years, but elsewhere the changes were smaller. Nearly half of the population in eastern Finland have suffered from recent back pain since 1972. Among men the prevalence of joint pain increased in Kuopio but not in North Karelia. The prevalence of varicose veins in North Karelian women declined from 37 % to 27 %. Overall, women suffered more from psychosomatic symptoms. Psychosomatic symptoms in eastern Finland decreased until 1987 and then rose slightly in 1992. On the whole, subjective health improved during the period when cardiovascular rates were decreasing, and by some indicators the development was more favourable in North Karelia than Kuopio.

REFERENCES

Anthenien L: Psychosomatik und Depression. Schweiz Rundschau Med (PRAXIS) 1991;80:971–975.

Aro S, Jylhä M, and Paronen O: Psychosomatic Symptoms and Perceived Health. A Viewpoint of Social Medicine. Sosiaalilaaket Aikak * J Soc Med 1982;19:206–211.

Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J, et al: English summary: Health, Functional Limitations and Need for Care in Finland. Basic Results from the Mini-Finland Health Survey. Helsinki and Turku: Publications of the Social Insurance Institution, Finland, AL: 32,1989. 793 pp.

Aromaa A, Klaukka T, and Nyman K: Questionnaires and Interviews in the Measurement of the Population's Health. Sosiaalilaaket Aikak * J Soc Med 1986;23:293–305.

Battie MC, Videman T, Gill K, Moneta GB, Nyman R, Kaprio J, and Koskenvuo M: Smoking and Lumbar Intervertebral Disc Degeneration: an MRI Study of Identical Twins. Spine 1991;16:1015–1021.

Boshuizen HC, Verbeek JHM, Broersen JPJ, and Weel ANH: Do Smokers Get More Back Pain? Spine 1993;18:35–40.

Cockerham WC, Sharp KBS, and Wilcox JA: Aging and Perceived Health Status. J Gerontol 1983;38:349–355.

Frymoer JW, Pope MH, Clements JH, Wilder DG, MacPherson B, and Ashikiga T: Risk Factors in Low-Back Pain. An Epidemiological Survey. J Bone Joint Surg [Am] 1983;65-A(2):213–218.

Halabi S, Zurayk H, Awaida R, Darwish M, and Saab B: Reliability and Validity of Self and Proxy Reporting of Morbidity Data: A Case Study from Beirut, Lebanon. Int J Epidemiol 1992;21:607–612.

Hunt SM, McKenna SP, and McEwen J: The Nottingham Health Profile. User's manual. Manchester 1989(b).

Hunt SM, McKenna SP, McEwen J, Backett EM, Williams J, and Papp E: A Quantitative Approach to Perceived Health Status: a Validation Study. J Epidemiol Community Health 1980;34:821–286.

Hunt SM, McKenna SP, McEwen J, Williams J, and Papp E: The Nottingham Health Profile: Subjective Health Status and Medical Consultations. Soc Sci Med 1981;15A:221–229.

Johnson RJ and Wolinsky FD: The Structure of Health Status Among Older Adults: Disease, Disability, Functional Limitation and Perceived Health. J Hlth Soc Behav 1993;34:105–121.

Jylhä M: Symptoms and Self-Assessment of Health among the Elderly. Sosiaalilaaket Aikak * J Soc Med 1982;19:252–260.

Kalimo E, Klaukka T, Lehtonen R, and Nyman K: English summary: Health Security in Finland and Needs for Development. Main Results of a Nationwide Health Security Survey Conducted in 1987. Helsinki: Publications of the Social Insurance Institution, Finland, M: 81, 1992. 343 pp.

Koivukangas P, Koivukangas J, Ohinmaa A, Kivelä S-L, and Krause K: NHP – a Method for Measuring Health-Related Quality of Life in Health Services Evaluation. Sosiaalilaaket Aikak * J Soc Med 1992;29:229–235.

Kottke TE, Puska P, Salonen JT, Tuomilehto J, Nissinen A: Changes in perceived heart disease risk and health during a community-based heart disease prevention program: the North Karelia Project. Am J Public Health 1984;74:1404–1405.

Kumpusalo E, Pekkarinen H, Neittaanmäki L, Penttilä I, and Halonen P: Identification of Health Status Dimensions in a Working-Age Population. An Exploratory Study. Med Care 1992;30:392–399.

Larson R: Thirty Years of Research on the Subjective Well-Being of Older Americans. J Gerontol 1978;3:109–125.

LaRue A, Bank L, Jarvik L, and Hetland M: Health in Old Age: How do Physicians' Ratings and Self-Ratings Compare? J Gerontol 1979;34:687–691.

Maddox GL and Douglass EB: Self-Assessment of Health: a Longitudinal Study of Elderly Subjects. J Hlth Soc Behav 1973;14:87–93.

Mossey JM and Shapiro E: Self-Rated Health: A Predictor of Mortality Among the Elderly. Am J Public Health 1982;72:800–808.

O'Connor FG and Marlowe SS: Low Back Pain in Military Basic Trainees. A Pilot Study. Spine 1993;18:1351–1354.

Paronen O, Pasanen M, Rantanen P, and Aro S: Test-Retest Study of Psychosomatic Symptoms among 14–15-Year-Old Schoolchildren. Sosiaalilaaket Aikak * J Soc Med 1982;19:234–239.

Rimpelä M, Rimpelä A, and Pasanen M: Perceived Symptoms among 12–18-Year-Old Finns. Sosiaalilaaket Aikak * J Soc Med 1982;19:219–233.

Schroll M, Ferry M, Lund-Larsen K, and Enzi G: Assessment of Health: Self-Perceived Health, Chronic Diseases, Use of Medicine. Eur J Clin Nutr 1991;45(Suppl 3):169–182.

Sievers K and Klaukka T: Back Pain and Arthrosis in Finland. How Many Patients by the Year 2000? Acta Orthop Scand 1991;62(Suppl 241):3–5.

Slätis P and Ruusinen A: Orthopedic Diseases and Trauma in Finland. Trends in Consumption of Health Services 1970–1985. Acta Orthop Scand 1991;62(Suppl 241):13–16.

Suominen S: Perceived Health and Life Control. A Theoretical Review and Empirical Study about the Connections between Health and Life Control Determined According to the Strength of the Sense of Coherence. National Research and Development Centre for Welfare and Health: Research Reports 26. Jyväskylä, Finland, 1993.

Symmons DPM, van Hemert AM, Vandenbroucke JP, and Valkenburg HA: A Longitudinal Study of Back Pain and Radiological Changes in the Lumbar

Spines of Middle Aged Women. I. Clinical Findings. Ann Rheum Dis 1991;50:158–161.

Thompson WG and Heaton KW: Functional Bowel Disorders in Apparently Healthy People. Gastroenterology 1980;79:283–288.

Tibblin G, Bengtsson C, Furunes B, and Lapidus L: Symptoms by Age and Sex. The Population Studies of Men and Women in Gothenburg, Sweden. Scan J Prim Health Care 1990;8:9–17.

Tissue T: Another Look at Self-Rated Health Among the Elderly. J Gerontol 1972;27:91–94.

Tornstam L: Health and Self-Perception. A Systems Theoretical Approach. Gerontologist 1975;15:264–270.

Tsang IKY: Perspective on Low Back Pain. Curr Opin Rheumatol 1993;5:219–223.

Zung WWK, Broadhead WE, and Roth ME: Prevalence of Depressive Symptoms in Primary Care. J Fam Pract 1993;37:337–344.

IV

Other Results

17. EVALUATING THE CHANGE PROCESS

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1. INTRODUCTION

Classically, most emphasis in the assessment of community programmes is placed on outcome evaluation. This is understandable because goal setting is based on the expectation of quantitative changes in risk factors and health behaviours.

However, all community programmes also define certain methods and activities, as well as the theoretical perspectives employed to achieve the desired goals. The theoretical frameworks used in the North Karelia Project are discussed earlier.

Process evaluation is an essential tool for understanding how the defined methods have actually worked and which factors/modifications were responsible for the changes in target behaviours and risk factors. Process evaluation can provide an assessment of how the programme was implemented, how people were exposed to the intervention measures, what kinds of adjustment occurred in the intervening variables, and how the changes manifest in different population subgroups over the course of time.

Process evaluation methods used in the North Karelia Project have been evolved and applied in the framework described earlier in the book. Activities have been logged, soft formative evaluation has been built into the activities, process evaluation variables have been included in the population surveys, and special studies conducted. Many of the evaluation tools have been used throughout the 20 years of the project, whereas some have been used specifically for evaluating various subprogrammes.

Previous chapters have described the health behaviour and risk factor changes over time, and in different population subgroups. Numerous

intervention activities and their outcomes are also described elsewhere in this book. This chapter presents certain process evaluation findings derived from the data of the population surveys.

2. METHODS

The process evaluation of the North Karelia Project has monitored the progressive phases of the process of health behaviour change. These were: 1) programme performance, 2) exposure to intervention, 3) intervening variables (awareness of personal risk factors, attitudes towards health behaviour changes, 4) knowledge and health beliefs, 5) skills, and 6) intentions to change health behaviour. Information on programme performance has been gathered from statistics on manpower, training meetings, production and distribution of health education material, mass media programmes etc.

Several indicators related to the risk factor and health behaviour change process were included in the baseline survey of 1972, and in the successive population surveys at five-year intervals. Postal health behaviour surveys, including process variables, were carried out twice a year during the first five years of the project and thereafter annually in both North Karelia and all Finland. The health behaviour surveys since 1978 have been a significant data base for the behaviour change process evaluation. Since 1989, these surveys have included a set of special process evaluation questions used in the CINDI programme. A log of activities was used during the first five years of the project, and occasionally thereafter. Many of the sub-programmes (e.g. the North Karelia Youth Project and the North Karelia Cholesterol Project) used a specially-tailored process evaluation.

3. RESULTS

3.1. Exposure to intervention and participation

The North Karelia Project has used a variety of channels to get its health messages across to the public. The proportion of North Karelians report-

ing they had participated in health education meetings on smoking and/or healthy nutrition during the past 12 months was 19 % among men and 25 % among women in in the 1977 survey (30–64-year-olds). This percentage has since remained rather stable among men and increased somewhat among women. Among 15–64-year-olds in 1992–93, about 25 % of men and 30 % of women reported attending a health education meeting dealing with smoking and healthy nutrition issues during the past year. In the health behaviour survey of autumn 1977 a high proportion of people reported familiarity with various health education leaflets produced by the project. A summary of this information is found in Table 17.1.

	REPORT HAVING READ	
LEAFLET ON	**MEN**	**WOMEN**
	%	%
PREVENTION OF HEART DISEASE	35	33
SMOKING	31	34
HEALTHY DIET	36	35
HIGH BLOOD PRESSURE	24	27
ADVICE TO HEART PATIENTS	17	20

Table 17.1. Proportion of people reporting in 1977 that they had read certain health education leaflets of the North Karelia Project.

	MEN						WOMEN						TOTAL
	AGE GROUP						AGE GROUP						
	15-24	25-34	35-44	45-54	55-64	TOTAL	15-24	25-34	35-44	45-54	55-64	TOTAL	
READING LEAFLETS	54	48	49	64	60	55	66	71	70	77	75	72	63
WATCHING TV	67	65	60	76	78	69	78	79	71	77	76	76	72
LISTENING TO RADIO	32	36	38	47	47	40	35	43	49	48	56	46	43
READING NEWSPAPER	63	61	56	68	61	61	69	75	75	73	66	72	67
READING MAGAZINES	57	55	47	46	51	51	74	79	73	76	73	75	63
LISTENING TO LECTURES	14	6	3	4	8	7	12	8	8	9	8	9	8

Table 17.2. Watching, listening or reading about health messages weekly or monthly in 1992–93 (%).

Awareness of health messages from various media was high in North Karelia in 1972–77, especially from newspapers, and has since persisted. In the interval from 1989 to 1994 half of the province's 15 to 64-year-olds reported receiving health related messages from the media at least weekly, and 85 % at least monthly (79 % of men and 91 % of women). The latter proportion increased from 82 % to 87 % during the period from 1989–90 to 1993–94 ($p<0.001$). Health messages from TV, newspapers and health leaflets became more common, while those from radio decreased. Table 17.2 shows media sources of health messages in 1992–93.

The proportion of people having a health check-up or screening during the past five years rose from 1972 to 1992 among both sexes (from 57 % to 85 % in men and from 59 % to 83 % in women). Among men, the steepest increase took place between the survey years of 1972 and 1977, whereas among women there was a continuous rise from 1972 to 1992. The health behaviour survey of autumn 1976 included a specific question about a special screening survey performed for heart disease risk factors; 44 % of the male and 26 % of the female population reported participating in such a survey.

In the health behaviour survey of autumn 1976 (at the end of the initial five-year period) about 29 % of men and 20 % of women stated that they had received heart disease prevention advice from their doctor during the previous six months. The respective figures for advice from a public health nurse were 30 % and 19%.

During the early days of the project, prevention of heart disease was much discussed in North Karelia. For instance, in the health behaviour survey of spring 1975, about 65 % of men and 72 % of women reported that prevention of heart disease had been discussed at their home during the previous six months, while about 52 % of men and 61 % of women reported the same for their work place. More recent social discussions and interactions are presented later in connection with the target risk factors.

Although most of the project activities have been organized by various community organizations over the 20 years, the project itself has carried out many evaluation surveys, other studies and trials. In the 1992–93 survey 28 % of males and 22 % of females reported having participated in some study or other conducted by the North Karelia

Project. In the age group 55–64 these proportions were as high as 53 % (men) and 38 % (women).

3.2. Smoking

The proportion of male smokers has declined remarkably over the 20 years in all age groups, but particularly among older men (Figure 17.1). In 1972 there was no significant difference in smoking prevalence between the 10-year age groups (30–59 years), but there was by 1992, with 38 %, 32 % and 27 % smokers in the age groups 30–39, 40–49 and 50–59, respectively ($p<0.001$).

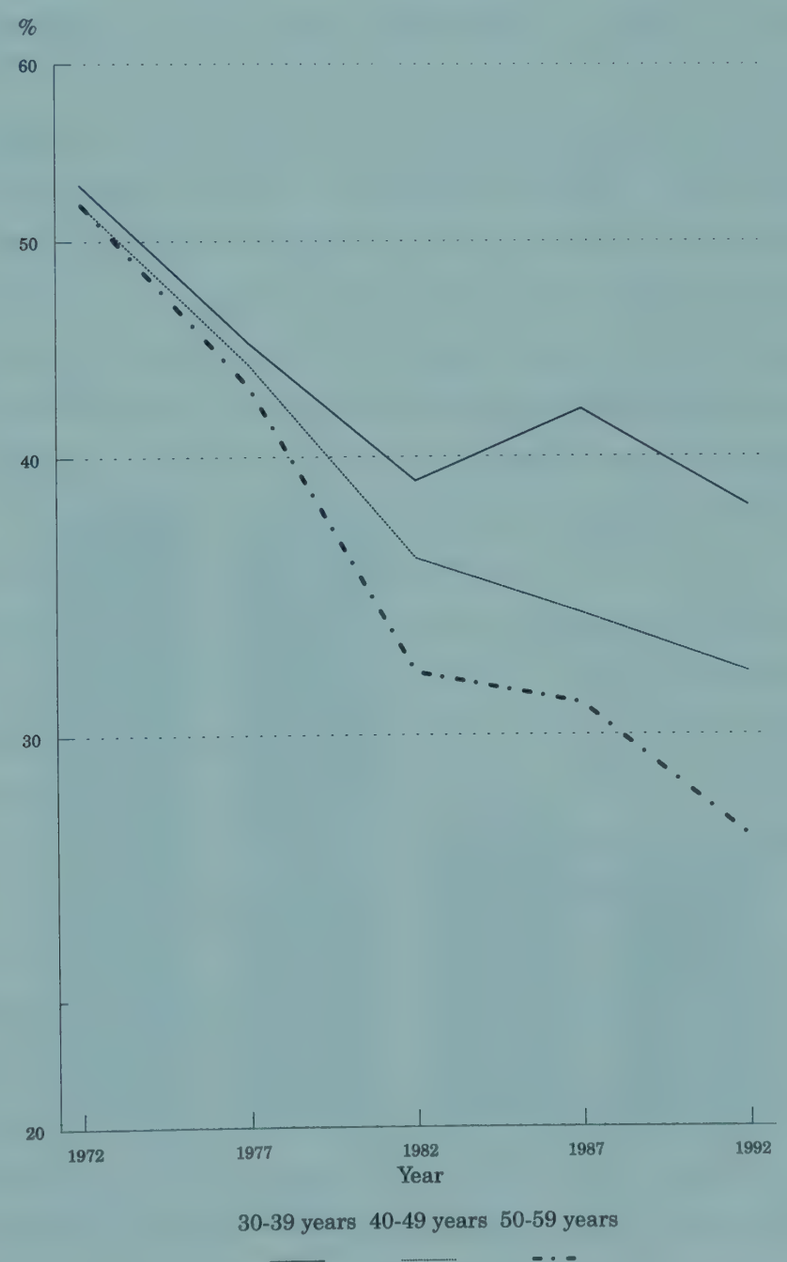

Figure 17.1. Proportion of regular smokers by age-group North Karelia, men, 1972–1992

Among women there has been an overall increase in smokers over the 20 years. Those in the oldest age group have smoked significantly less than younger women. In 1972 smoking was especially common in the youngest age group, while in 1992 the proportions of smokers were 21 %, 20 % and 10 % in the age groups 30–39, 40–49 and 50–59, respectively ($p<0.001$).

Male smokers reported receiving advice from a physician to quit more often than female smokers. However, the clear difference between the sexes in this respect observed from 1977 to 1987 had disappeared by 1992 (31 % vs 29 % for men and women, respectively). Older smoking men are more likely to have received advice than younger men, but in women there has been no such age disparity. Advice was also received from public health nurses: in 1992–93 about 29 % of male smokers and 33 % of female smokers reported that during the previous year they had received advice from a public health nurse to stop smoking.

Throughout the years, about 55–60 % of daily smokers of both sexes have indicated the wish to stop smoking, while about 10 % say they do not want to give up. About 75 % of daily smokers have reported that they smoke too much. There has been no sex difference in the willingness to stop smoking or in the subjective conceptions of smoking. More generally, there have also been relatively minor differences between various population groups (with different smoking prevalences) in their willingness to quit.

The proportion of smokers reporting attempts to stop smoking during the previous six months has consistently been higher among women than men. Quitting attempts declined from the late 1970s to the early 1990s, but are still persistently quite high. About 22 % of male smokers and 29 % of female smokers reported having tried to quit smoking during the previous 12 months in 1992–93.

In the 1986-87 surveys, smokers were asked the most important reason for their attempt to quit: 36 % indicated prevention of disease (39 % among men/31 % among women), 13 % treatment of a disease (16 %/10 %), 12 % high cost (15 %/8 %), 9 % hygiene (4 %/15 %), 4 % example to children (3 %/6 %) and 13 % (of women) pregnancy.

The 1992–93 health behaviour surveys asked people to specify others who had influenced their smoking cessation attempts. About

37 % reported that a family member had influenced them (38 % men/ 35 % women), while 18 % mentioned a friend (18 %/17 %), 16 % a doctor or nurse (15 %/16 %) and 6 % a work mate (8 %/3 %). About 41 % of smokers who had made an attempt to quit during the previous year said that nobody had specifically influenced them in their attempt.

The role of social support in smoking cessation was analyzed from the 15-year cohort of the baseline survey. Marital status (or change in it), and happiness of marriage were used as indicators of close social support; men who stayed married or got married were more than twice as likely to quit compared with single, divorced or widowed men (48 % vs 22 %, $p<0.001$)(Figure 17.2). In women, however, there was no difference between the marital groups. In the multiple logistic regression model, happiness of marriage was a significant predictor of cessation in men.

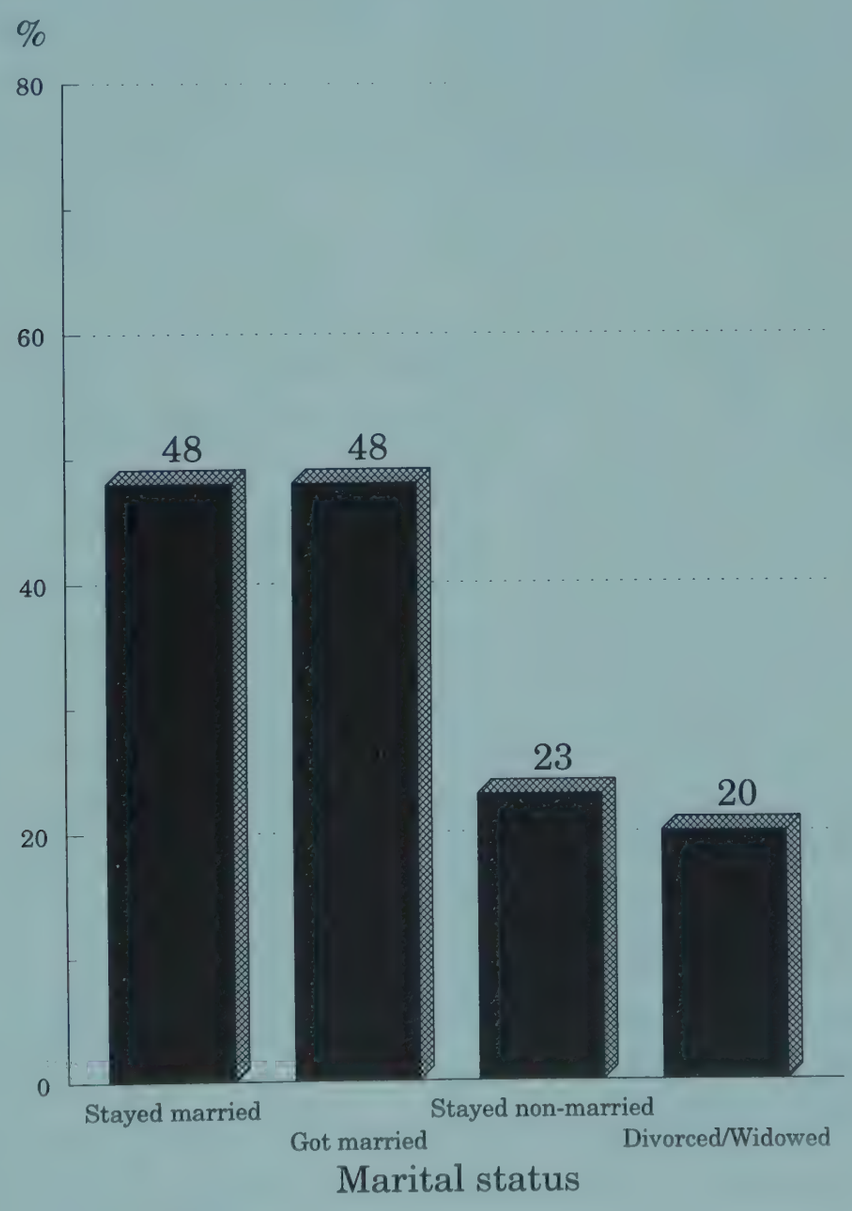

Figure 17.2. Proportion of smokers to quit in 15 years (1972–1987) by marital status North Karelia, men (25–49 years at baseline)

3.3. SERUM CHOLESTEROL AND DIET

Serum cholesterol levels have declined remarkably and in parallel in all 10-year age groups over the 20-year period. Thus the differences by age have remained unchanged in both sexes.

The proportion of people having had their cholesterol measured during the last five years increased considerably in all age groups during the first five year period of the project. From 1977 the proportion somewhat declined, however, particularly among the youngest age group. But the intensive activities related to the North Karelia Cholesterol Project in the late 80s had the effect of boosting the proportion to over 70 % and eliminating the age differences (Figure 17.3). After the first year of the Cholesterol Project the proportion of people reporting a cholesterol measurement(s) during the previous 12 months peaked at 30 %. The level of measurement remained high among most population groups in North Karelia (Table 17.3).

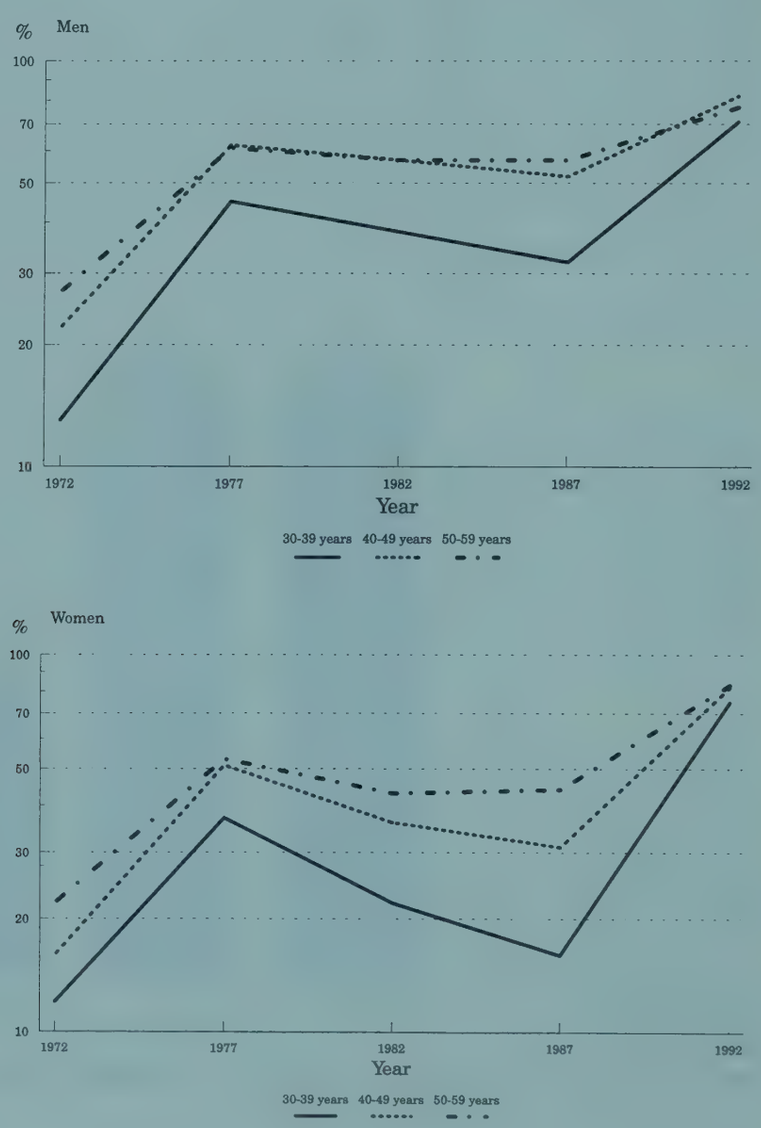

Figure 17.3. Cholesterol measurement during last five years by age group in North Karelia, 1972–1992

POPULATIONSHIP	MEN	WOMEN
AGE		
15–24	57	49
25–34	60	63
35–44	80	87
45–54	80	84
55–64	83	86
CIVIL STATUS		
MARRIED	80	78
SINGLE	67	91
OTHER	67	91
PLACE OF LIVING		
JOENSUU	74	81
SMALL TOWNS	66	65
RURAL	73	76
YEARS OF EDUCATION		
– 8 YEARS	73	75
9–11 YEARS	74	74
12–YEARS	69	75
PROFESSION		
AGRICULTURE	74	70
INDUSTRIAL	76	90
OFFICE/SERVICE	77	83
UNEMPLOYED	67	55
TOTAL	72	75

Table 17.3. Proportion of people (15–64 years) who report that their serum cholesterol has been measured during the previous five years in the 1992–93 surveys.

In 1992–93 about 28 % of men and 27 % of women aged 15–64 years reported being told they had elevated blood cholesterol. This prevalence was naturally low in the youngest age group (15–24 years) at 5 % of men and 8 % of women, and very high in the oldest (55–64 years) at 46 % and 55 %. In the same survey about 79 % of men and 86 % of women who had had a cholesterol measurement said they knew their own cholesterol value. Furthermore, about 60 % of people reported being given dietary advice in connection with their cholesterol measurement.

Use of skim milk was very uncommon in 1972: less than one percent reported using it as their milk preference. Although the proportion of skim milk users remained very low till the early 1980s, the beginnings of a broad trend can be detected when the milk preferences are analysed according to age groups, and particularly educational groups. Of those who used milk, about 5 % of men and 4 % of women in the highest education tertile reported using skim milk in 1977. Thereafter the differences between educational tertiles have widened: 35 % of men in the

highest educational tertile used skim milk in 1992 compared with 8 % in the lowest. For women the differences were much less: the respective figures are 40 % and 28 % (Figure 17.4).

A parallel socioeconomic difference in the take-up of new dietary habits was observed in the use of vegetable oil in cooking. The tertile of the best educated already started using vegetable oil in the 1970s, while

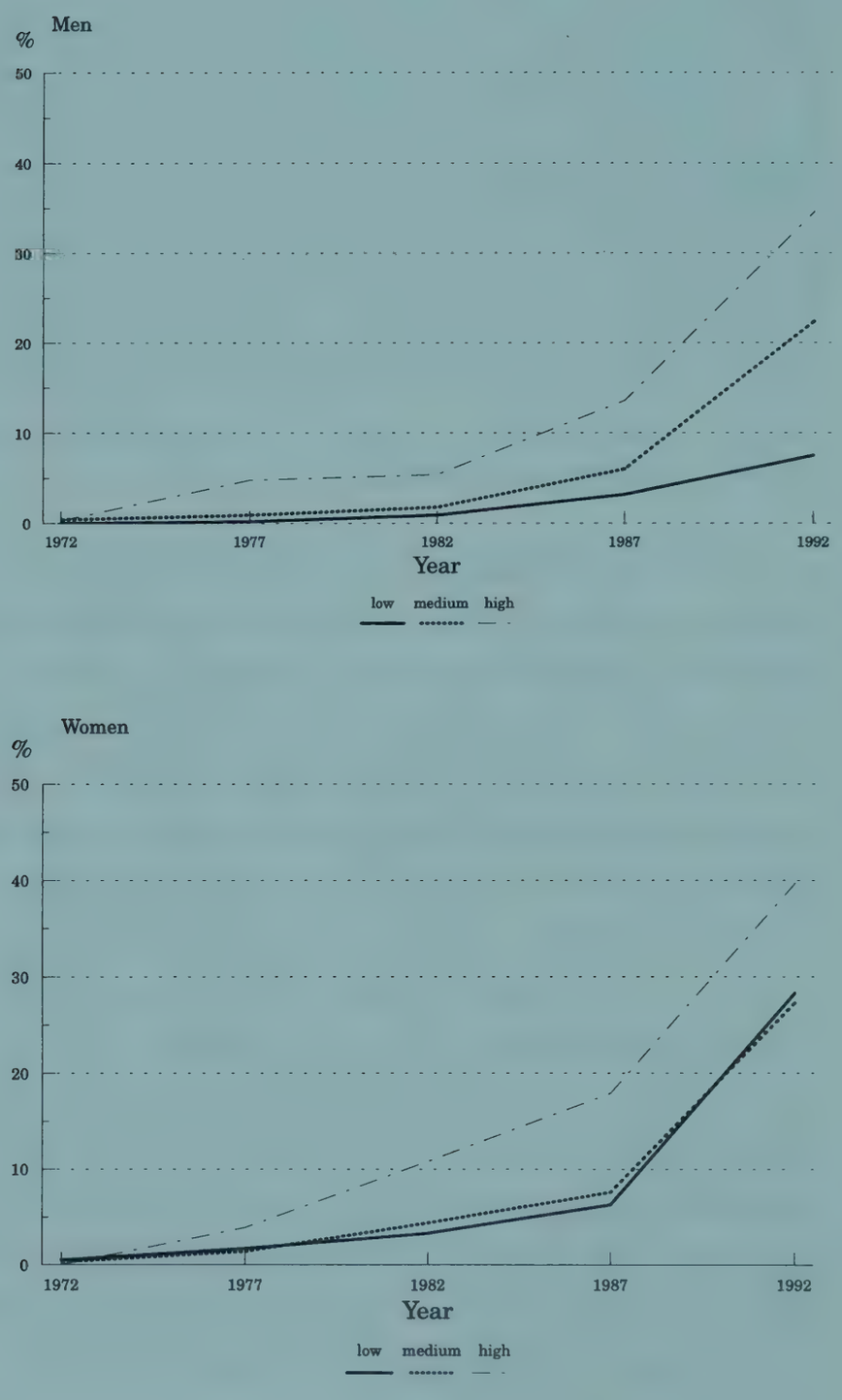

Figure 17.4. Use of skim milk by education (school years) North Karelia, 1972–1992

it only became more widely used among the less educated in the late 1980s and early 1990s (Figure 17.5).

Eating at home has always been the norm and thus the prime target for the dietary intervention. However, lunch outside the home has become progressively more common. In the 1992–93 health behaviour survey, 48 % of people reported eating their lunch at home, 25 % at a

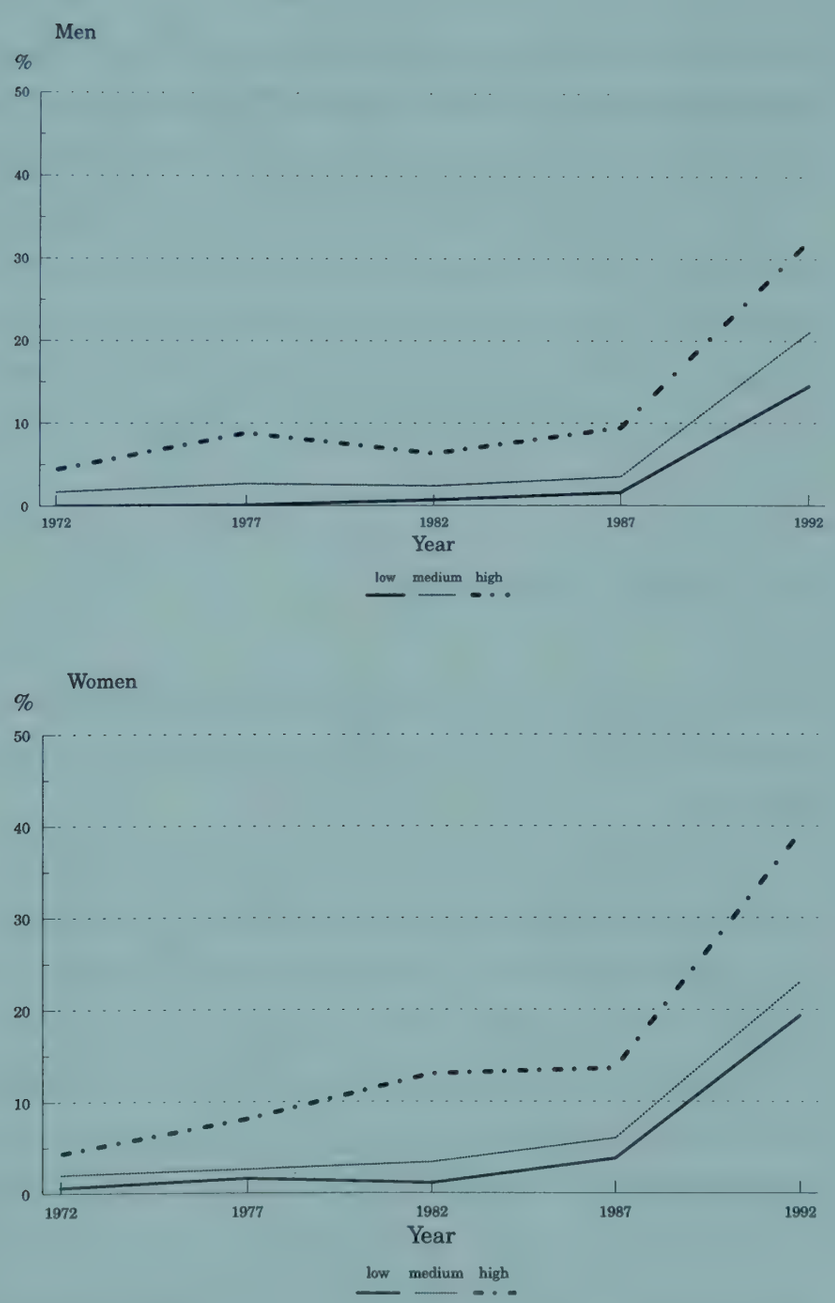

Figure 17.5. Vegetable oil in cooking by education (school years) North Karelia, 1972–1992

work site canteen and 18 % elsewhere. Only 10 % said they ate no lunch at all. About 41 % of people said that they usually ate both lunch and supper, 33 % only lunch, and 25 % only supper. About 78 % reported eating breakfast.

Throughout the project period, attempts to change the diet for health reasons were very commonly reported, especially regarding fat reduction and increased vegetable consumption. The figure in chapter 11 shows the trends in these attempts in North Karelia over the 1979–93 period. The influence of the intensive intervention period of the Cholesterol Project can clearly be seen. In the 1993 survey more than 50 % of men and about 70 % of women reported having changed their diet somewhat during the preceding year for health reasons.

In the 1992–93 health behaviour surveys people were asked about those who had influenced their fat consumption reduction. About 19 % mentioned a family member (especially among men) and 13 % mentioned a doctor or nurse. The figures were rather similar for salt reduction.

People in North Karelia had great confidence in the nutrition message. In the 1992 risk factor survey people were asked to respond to the statement "Changing the diet in middle-age is no longer worthwhile". About 54 % completely disagreed, 27 % somewhat disagreed, 12 % couldn't say, 6 % somewhat agreed, and only 2 % completely agreed.

3.4. Blood pressure

Systolic and diastolic blood pressure levels have declined in all 10-year age groups during the 20 years, and the age differences have prevailed in both sexes.

During the first five years of the North Karelia Project the intervention focused largely on the enhanced detection, treatment and follow-up of hypertensives. Process evaluation results of this period have been presented in greater detail (Puska et al. 1991).

In the 1977 survey most North Karelians reported having had their blood pressure measured during the previous five years. About 33 % of men and 41 % of women (30–64 years) reported being told they had elevated blood pressure, while 18 % of men and 24 % of women reported current hypertension (detected or treated by a physician). In the same

survey 12 % of men and 17 % of women reported being on antihypertensive medication.

During the 1972–77 period a special province-wide hypertension register was launched by the project to support the hypertension intervention. By 1977 nearly 20.000 of North Karelians had been registered and were being monitored. In the health behaviour survey of autumn 1976, 13 % of the male and 14 % of the female population (25–64 years) reported being in the hypertension register of the project and having been issued the yellow hypertension card.

Blood pressure measurements increased substantially during the first five years of the North Karelia Project, particularly among men. From 1972 to 1977 the proportion of men having had their blood pressure measured during the last five years increased from 67 % to 95 %, and of women from 86 % to 96 %. Since then the situation has stabilized, with only slight differences in blood pressure measurement rates between age groups and educational tertiles. Nevertheless, the best educated have continuously had the highest measurement frequencies (Figure 17.6).

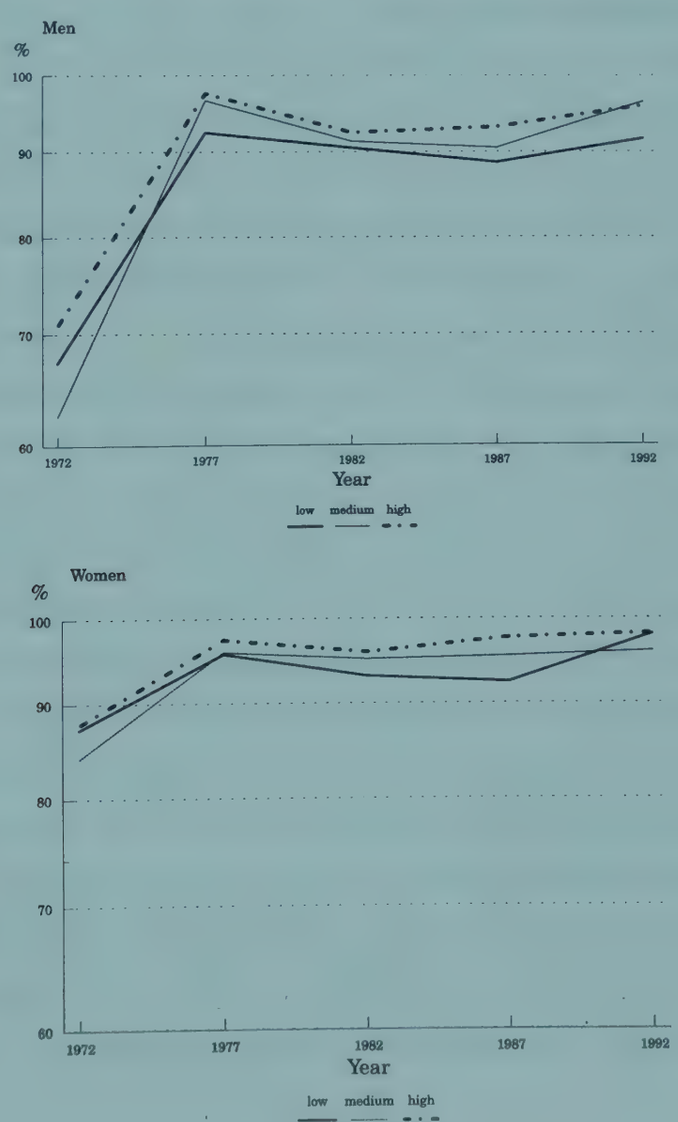

Figure 17.6. Blood pressure measurement during last five years by education (school years) North Karelia, 1972–1992

The hypertension treatment level also remained fairly constant; e.g. the prevalence of detected and treated hypertension among men/women in North Karelia was about 11 %/12 % in 1986–87 and about 12 %/12 % in 1992–93 (15–64 years, health behaviour survey). The respective proportions of people under antihypertensive medication were 8 %/8 % in 1986–87 and 8 %/10 % in 1992–93.

In the 80s and 90s the project began to invest much effort in non-pharmacological interventions to reduce blood pressure levels. One indicator used to gauge the accuracy of health education on non-pharmacological measures to combat hypertension in the health care setting has been the frequency of received advice to reduce the risk factors. For example, the frequency of weight reduction advice reported by obese hypertensives was relatively high in the late 1980s and early 1990s. The proportion of hypertensives reporting such advice has increased during the last few years.

3.5. Other aspects

The risk factor survey questionnaire in 1992 carried the statement "heart disease can be prevented by healthy lifestyles". About 20 % completely agreed, 53 % mainly agreed, 21 % found it difficult to say, 6 % somewhat disagreed and less than 1 % completely disagreed.

The health behaviour surveys since 1978 have contained a standard question asking people to choose the most important single reason for the high morbidity of Finnish adults. Figure 17.7 gives the trends in the standard choices. "Stress, difficult life situation etc." has always been the most common response: about 32 % in 1992–93. The other two common choices have been "unhealthy nutrition" and "lack of physical activity": both about 18 % in 1992–93. Women have more often mentioned diet, men more often physical activity. "Unhealthy nutrition" peaked as a choice in 1985, "stress etc." has generally somewhat declined over recent years, while "lack of physical activity" and "overweight" have increased.

The health behaviour surveys in 1992–93 asked a very general question on whether people had made changes in their lifestyle recommended by the project. This somewhat vague question produced a positive answer from 35 % of men and 39 % of women.

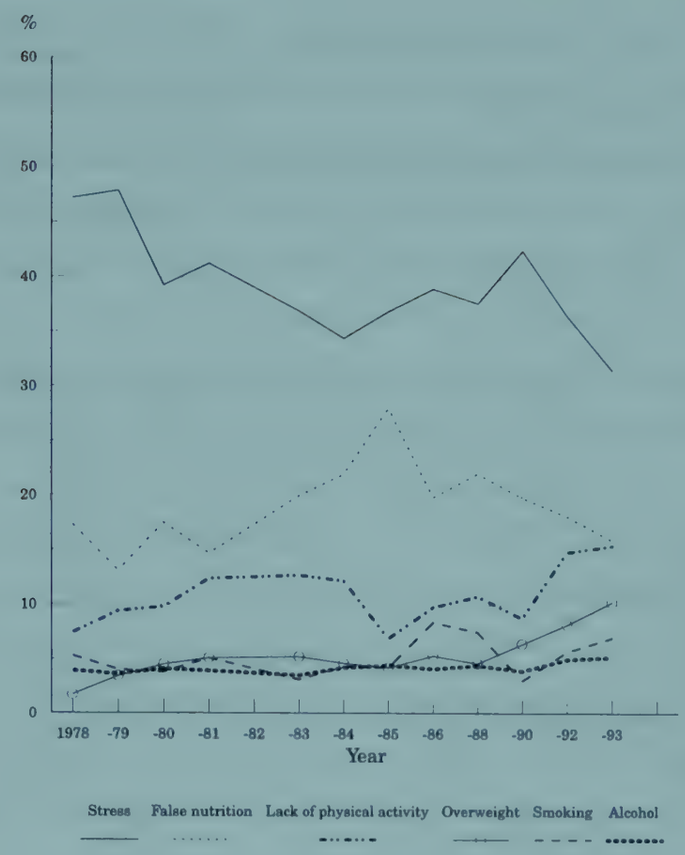

Figure 17.7. The most important reason for high morbidity rate among the adult population in Finland North Karelia in 1978–93, 25–59 years old

The same surveys went on to ask people for their opinion as to whether the North Karelia Project has benefited the health of the province's population. The distribution of the answers received was as follows: enormously 20 %, substantially 34 %, somewhat 39 %, only a little 5 %, not at all 1 %. There was little difference between the sexes, though the women tended to be slightly more more positive than the men.

4. Discussion

This chapter presents some rather miscellaneous data to help explain the nature of the change process in North Karelia. Naturally this will need to be supplemented by information from other chapters, and some of the experiences are more thoroughly discussed in chapter 21.

The process-related questions in the risk factor – and especially the health behaviour – surveys have proven quite useful not only for this type of summative evaluation, but also in the on-going management of the project. The "hard data", however, have major restrictions and are well complemented and supplemented by qualitative evaluations, and by the feedback the project team receives from the people on a daily basis.

However, even the hard data reveal convincingly that the North Karelia Project has clearly been a visible enterprise in the region (as indeed it has later been in all Finland). The project activities concerning blood pressure and cholesterol control, for example, have been very far-reaching. Project-related issues have been topical items of discussion in North Karelia throughout the years. The level of knowledge about the risk factors (data not presented here) has been high, the intention to change them has been common, and people have generally had confidence in the message.

Clearly, all these developments formed the background to the favourable health behaviour and risk factor changes reported in other chapters. There have obviously been a number of other intervening factors important in the adopting and maintaining of healthier lifestyles. As people have learned and applied practical change skills the entire social environment has started to foster further lifestyle change.

As far as dietary changes are concerned, the marked growth of interest on the part of the food industry has resulted in many novel products to assist the transition to healthier eating. The updated and reinforced anti-smoking legislation has likewise facilitated social change in a more smoke-free direction. Another important social factor is that many of those who adopted healthier heart lifestyles did so a generation ago as children; they perhaps have children of their own now, and collectively they are bound to have a substantial influence on the health behaviour of society.

REFERENCES

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J, Björkqvist S, Koskela K, Neittaanmäki L, Takalo T, Kottke K, Mäki J, Sipilä P, Varvikko P. Community control of cardiovascular diseases – the North Karelia Project: evaluation of a comprehensive community programme for control of cardiovascular diseases in 1972–1977 in North Karelia. WHO/EURO, Monograph Series, Copenhagen 1981.

18. PREDICTING ISCHEMIC HEART DISEASE MORTALITY WITH THE CLASSICAL RISK FACTORS

Erkki Vartiainen, Pekka Jousilahti, Juha Pekkanen, Jaakko Tuomilehto and Pekka Puska

1. INTRODUCTION

Before the start of the North Karelia Project, the prevailing evidence suggested that the three risk factors of smoking, elevated serum cholesterol and elevated blood pressure explained much of the ischemic heart disease (IHD) risk. The majority of the relevant information came from the Framingham Study (Kannel 1988), from other major prospective cohort studies mainly in the U.S. (The Pooling Project Research Group 1978) and from the Seven Countries Study (Pekkanen et al. 1989). This chapter will describe the effect of these three "classical" risk factors on IHD mortality in eastern Finland. The results are based on the prospective follow-up of the original baseline survey cohort of the North Karelia Project.

2. MATERIAL AND METHODS

The 1972 baseline survey of the North Karelia Project involved a 6.6% random sample of the 25–59 year old population of the province. These analyses were restricted to the 9 765 surveyed persons aged 30–59 years old; those who had reported myocardial infarction during the year preceding the survey were excluded. The methods applied in the survey are described in an earlier chapter.

Baseline risk factor measurements were linked to the IHD mortality data (ICD 410–414) of the National Mortality Register from 1972 to 1987 using the personal social security number. The International Classification of Diseases, 8th revision, was used during the whole follow-up period.

Individuals with all risk factors measured are presented in Table 18.1. Age standardization was done by the direct method in three age groups (30–39, 40–49, 50–59). In the risk ratio calculations the smallest risk category was assigned the value 1. A logistic regression model was used in multivariate analyses.

	MEN				WOMEN			
	30-39	40-49	50-59	TOTAL	30-39	40-49	50-59	TOTAL
SUBJECT	1621	1770	1264	4655	1652	1861	1588	5101
PERSON YEARS	23704	24739	16008	64451	24545	27260	22525	74330
CORONARY DEATHS	23	130	187	340	4	20	63	87
RISK FACTOR INFORMATION AVAILABLE								
SMOKING	1585	1701	1175	4461	1626	1818	1543	4987
BLOOD PRESSURE	1535	1682	1198	4415	1567	1780	1496	4843
CHOLESTEROL	1529	1676	1201	4406	1558	1776	1491	4825
ALL RISK FACTORS	1499	1617	1127	4243	1535	1738	1449	4722
PERSON YEARS	21960	22683	14316	58959	22804	25513	20591	68908
CORONARY DEATHS	19	114	168	301	4	19	53	76

Table 18.1. Subjects of the cohort study.

3. RESULTS

In men, age standardized IHD mortality in the lowest total serum cholesterol category (less than 5 mmol/l) was 1.66 per 1000 person years, while if serum cholesterol exceeded 10 mmol/l the mortality was 17.5 (Figure 18.1). The risk ratio increased exponentially with the cholesterol level. In women the number of deaths was too small to analyse the lowest cholesterol category, so we pooled the two lowest categories. Mortality in the lowest cholesterol group was then 0.58 per 1000 person years, compared with 5.27 if the level exceeded 10 mmol/l (Figure 18.2).

In men, systolic blood pressure began elevating the risk for IHD mortality from as low as 120 mm Hg (Figure 18.3). In women the two lowest categories were pooled because of the sparseness of cases. The risk ratio in the highest systolic blood pressure category compared to the lowest was about seven in men and 14 in women (Figure 18.4). The effect of diastolic blood pressure on IHD mortality was about the same as systolic pressure, both in men and women (Figures 18.5 and 18.6).

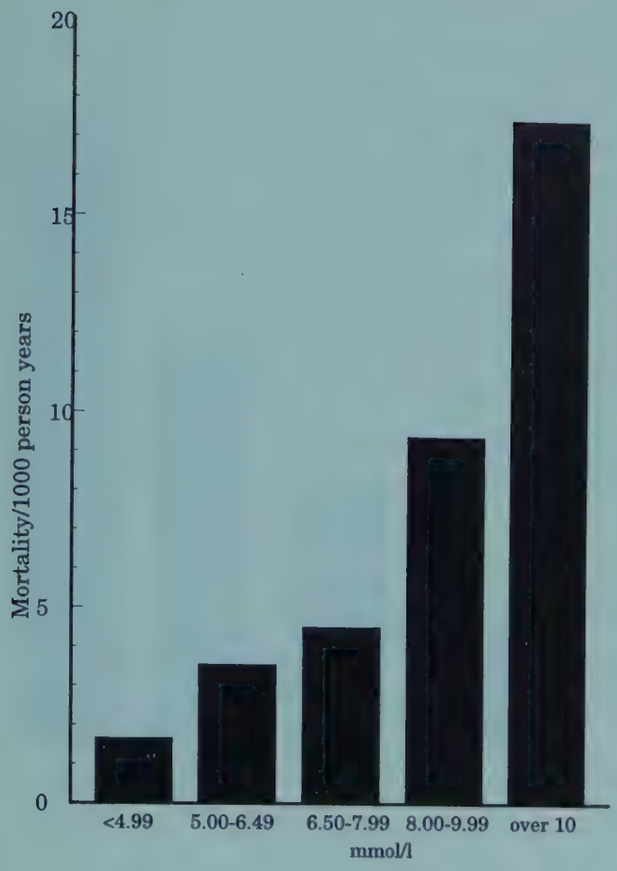

Figure 18.1. IHD Mortality by cholesterol level
Men

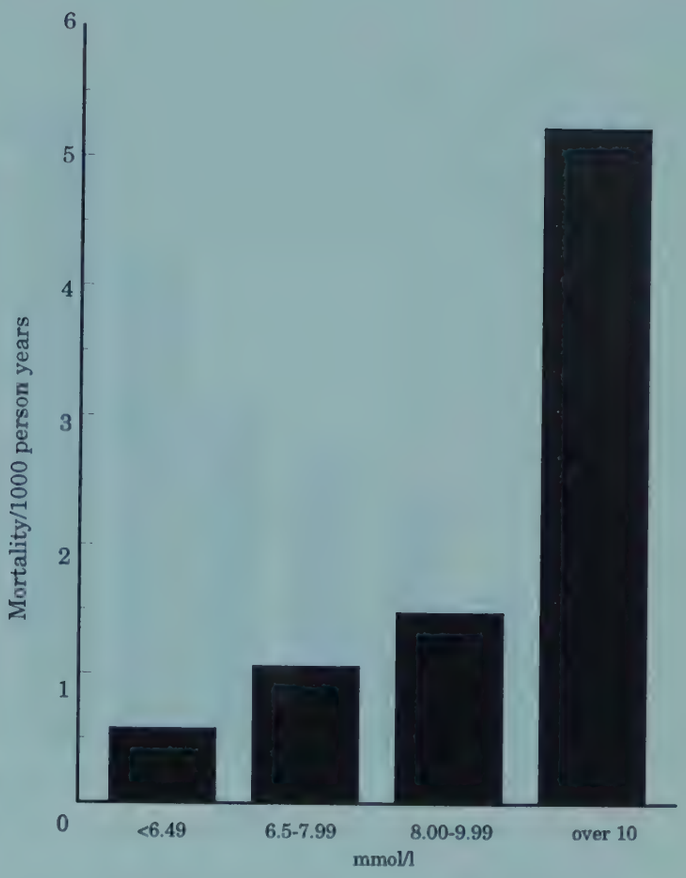

Figure 18.2.IHD Mortality by cholesterol level
Women

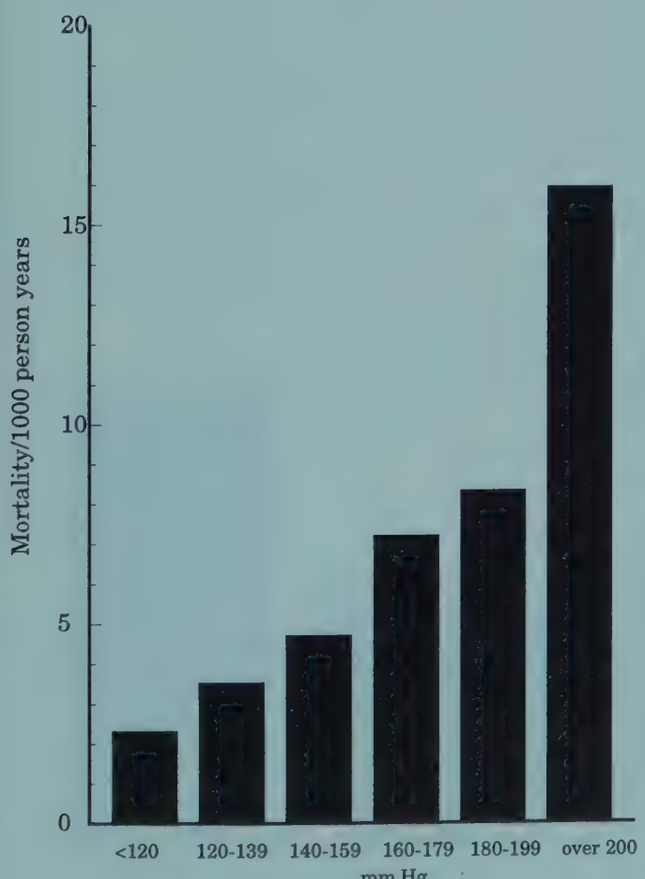

Figure 18.3. IHD mortality by systolic blood pressure level
Men

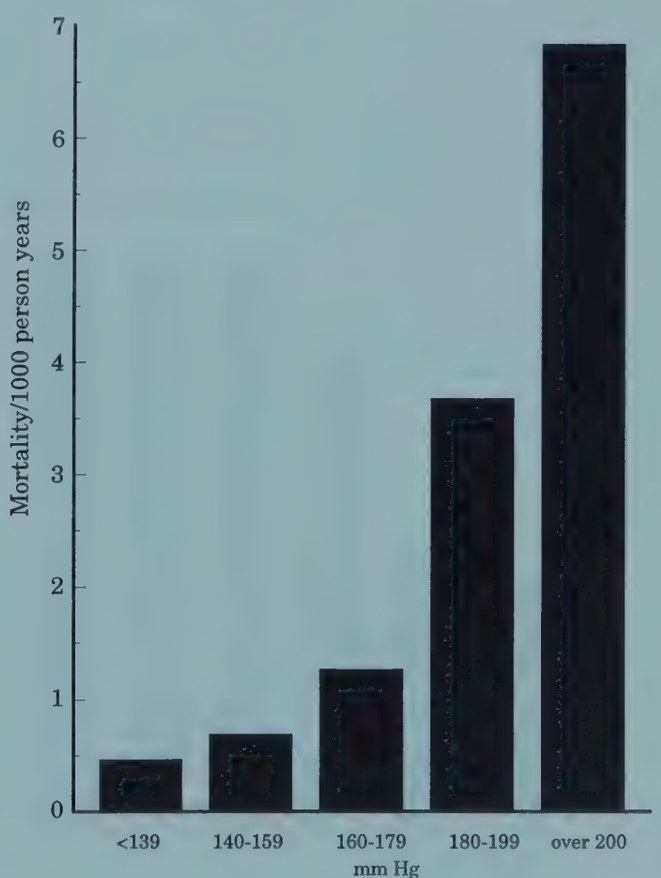

Figure 18.4. IHD mortality by systolic blood pressure level
Women

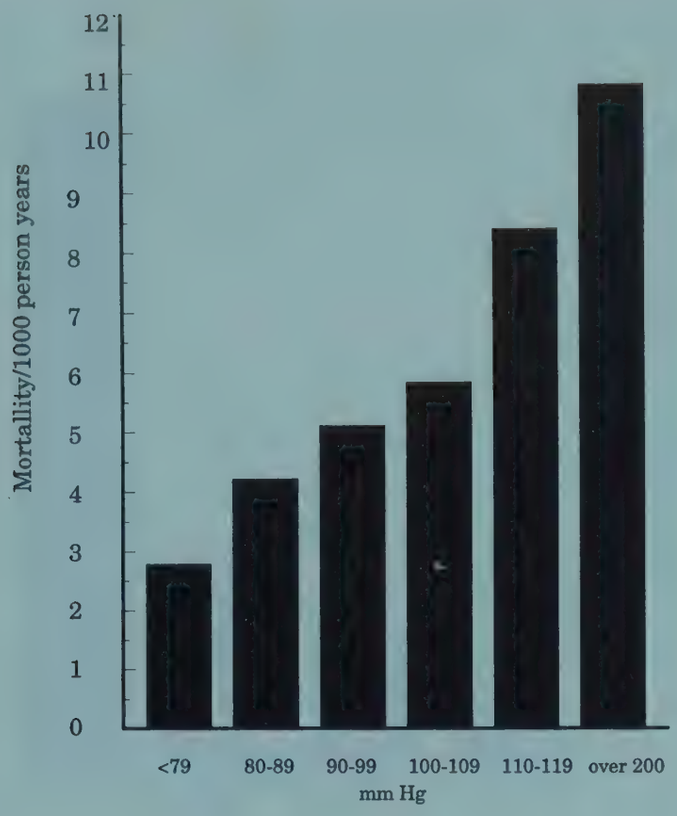

Figure 18.5. IHD mortality by diastolic blood pressure level Men

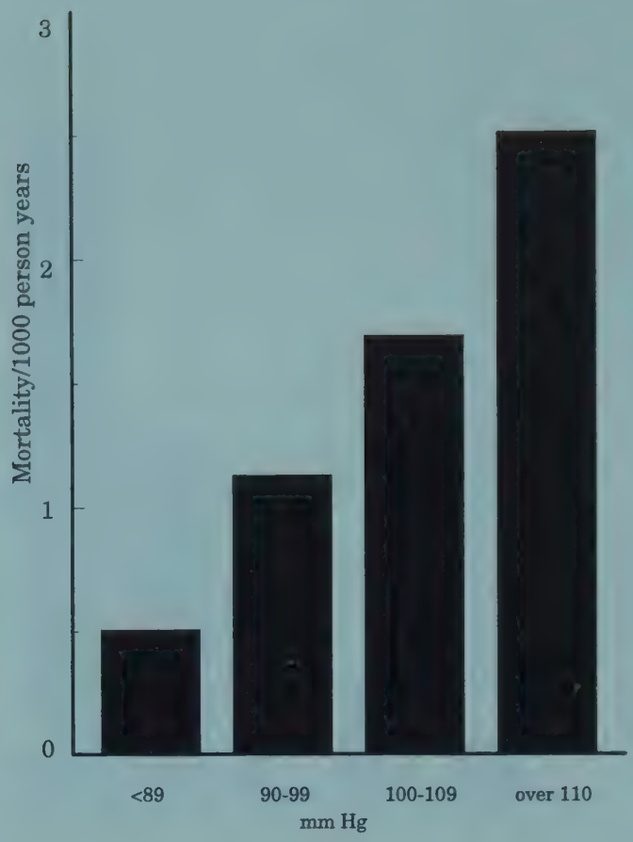

Figure 18.6. IHD mortality by diastolic blood pressure le Women

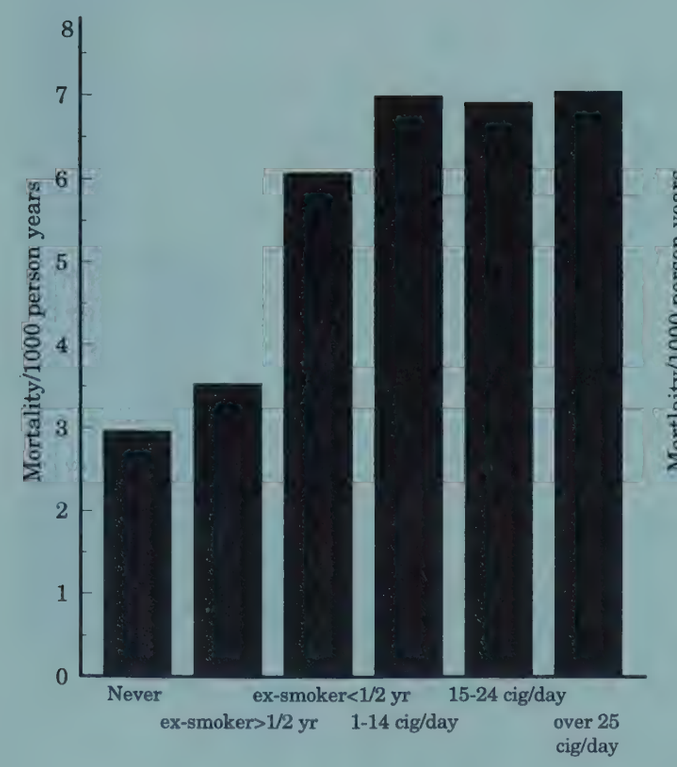

Figure 18.7. IHD mortality by smoking Men

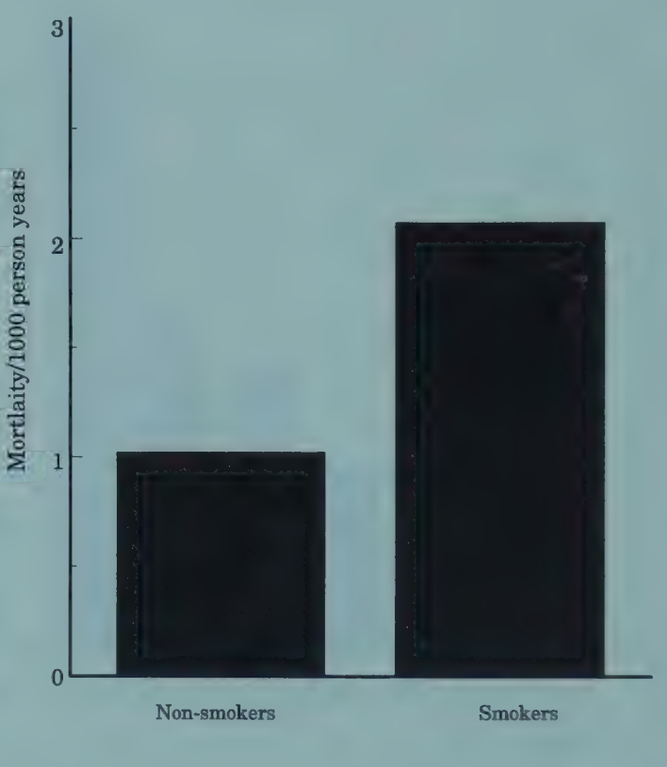

Figure 18.8. IHD mortality by smoking Women

Smoking increased the risk in men 2.5-fold (Figure 18.7). The number of cigarettes smoked in a day seemed to have no impact on mortality. The risk of those who had stopped smoking more than half a year ago was about the same as in the never smokers. By contrast, men who had stopped smoking less than half a year ago had about the same level of risk as the smokers, probably because many of them had re-started smoking during the follow-up period. In women, smoking increased the risk 2-fold (Figure 18.8). The small number of smokers and cases in women made it impossible to divide women into more categories.

In the multiple logistic regression model all the risk factors had a statistically significant impact (Table 18.2). The odds ratio of systolic blood pressure was calculated for 10 mmHg intervals and diastolic blood pressure for 5 mm Hg intervals. Cholesterol was calculated for 1 mmol/L intervals and age for every five years. The risk ratios were almost identical in the sexes. However, in the multivariate analysis smoking seemed to be more important in women than men, although the difference in the odds ratio between them was not statistically significant.

The risk of IHD death was 5.24 times higher in men than women. When smoking, serum cholesterol, and systolic and diastolic blood pressure were included in the model the odds ratio fell to 4.61. Hence only 15% of the difference between men and women could be explained by the classical risk factors.

When both systolic and diastolic blood pressure were included at the same time only systolic blood pressure was statistically significant,

RISK FACTOR	UNIT	MEN	WOMEN	BOTH
AGE	5 YR	1.67 (1.53;1.82)	1.48 (1.22;1.80)	1.63 (1.50;1.77)
SMOKING	0=NO, 1=YES	2.23 (1.72;2.89)	3.68 (2.01;6,74)	2.40 (1.88;3.07)
SYSTOLIC BLOOD PRESSURE	10 mmHg	1.16 (1.08;1.24)	1.16 (1.03;1.31)	1.15 (1.09; 1.23)
DIASTOLIC BLOOD PRESSURE	5 mmHg	1.03 (0.96;1.10)	1.05 (0.94;1.20)	1.03 (0.98;1.10)
CHOLESTEROL	1 mmol/L	1.46 (1.33;1.60)	1.39 (1.20;1.60)	1.43 (1.32;1.54)
GENDER	0=WOMAN, 1=MAN	–	–	4.61 (3.42;6.23)

Table 18.2. Logistic regression model on ischaemic heart disease mortality (odds ratios and 95% confidence intervals)

whereas if they were added in separate models both blood pressures were statistically significant. Thus systolic blood pressure seemed to predict IHD mortality slightly better, and when systolic blood pressure was used diastolic blood pressure did not improve the prediction of risk.

4. DISCUSSION

These results confirm that the classical risk factors are important predictors of IHD mortality in Finland. They seem to be equally important in both sexes, although in the multivariate analyses smoking was more pronounced in women. This may be the consequence of lower blood pressure and cholesterol level among smoking women, because smoking in eastern Finland in 1972 was relatively rare in women, and more common in the upper social class.

Some other studies have found smoking to be a less obvious risk factor in women. In the Framingham study smoking seemed to be a more important predictor in men than in women, while a Swedish cohort study observed smoking not to be a significant risk factor in women (Stokes et al. 1987). However, in most cohort studies smoking has increased IHD risk, with the effect apparently greater among the youngest subjects (Corrao et al. 1990). Blood pressure is an independent risk factor for both men and women in all the cohort studies (Corrao et al. 1990).

IHD mortality in middle-aged men is much higher than in women. In this cohort study 7.3 % (N=340) of men and 1.7% (N=87) of women died from IHD during the 15 year follow-up period. The risk factors explained only 15% of this difference. In the international MONICA study men in Finland had 6.2 times higher mortality than women, whereas in Scotland it was 3.3 times higher. In Beijing the risk ratio was smallest, at 1.8. There are no good explanations for these disparities between countries (WHO Monica Project, 1987).

In women it was not possible to assess the difference in mortality between the category with the lowest cholesterol values (below 5 mmol/l) and that with 5–6.5 mmol/l because of the small number of women and deaths at the lower end of the cholesterol distribution. The odds ratios calculated for 1 mmol/l increases in serum cholesterol were about the

same in men and in women, suggesting that cholesterol is equally important in men and women.

We also assessed mortality in the group of men with a normal risk factor level in the 1972 survey, i.e. blood cholesterol less than 5 mmol/l, blood pressure below 140/90 mm Hg, and no smoking. There were just 95 men in this group and none of them died of IHD during the 20 years of follow-up, which only serves to emphasize the extremely high risk factor level in eastern Finland in the early 1970s.

In summary, high serum cholesterol level, high blood pressure and smoking are important factors explaining the high IHD mortality rates in Finland among both sexes. These findings confirm earlier results from follow-up of the same cohort over a shorter monitoring period. Although these results were achieved during the intervention period of the project, they corroborate the information used in the project planning phase and support the initial choice of target risk factors.

REFERENCES

Corrao JM, Becker RC, Ockene IS, Hamilton GA. Coronary Heart Disease Risk Factors in Women. Cardiology 1990;77(suppl. 2):8–24.

Kannel W (editorial). Contribution of the Framingham Study to the Conquest of Coronary Artery Disease. Am J Cardiol 1988;62:1109–1112.

Pekkanen J, Nissinen A, Puska P, Punsar S, Karvonen MJ. Risk factors and 25 year risk of coronary disease in male population with a high incidence of the disease: the Finnish cohort of the seven countries study. Br Med J 1989;299:81–85.

The Pooling Project Research Group. The relationship of blood pressure, serum cholesterol, smoking habits, relative weight and ECG abnormalities to incidence of major coronary events: Final report of the Pooling Project. American Heart Association, Dallas 1978. Amer Heart Assoc Monograph 60.

Stokes J, Kannel WB, Wolf PA et al. The relative importance of selected risk factors for various manifestations of cardiovascular disease among men and women from 35–64 years: 30 years of follow-up in the Framingham Study. Circulation 1987;75(suppl. V):V65–V73.

19. DO CHANGES IN RISK FACTORS IN FINLAND EXPLAIN THE CHANGES IN ISCHEMIC HEART DISEASE MORTALITY ?

Erkki Vartiainen, Pekka Puska,
Juha Pekkanen, Jaakko Tuomilehto
and Pekka Jousilahti

1. INTRODUCTION

Although ischemic heart disease (IHD) mortality is declining in many countries, it is still on the increase elsewhere (Uemura & Pisa 1985). The extent to which changes in the major risk factors of serum cholesterol, blood pressure and smoking explain the IHD mortality trends is a crucial public health concern. Most industrialized countries are developing and adopting nationwide strategies to prevent IHD, mainly by reducing the population levels of these risk factors.

There have been only a few attempts to quantify the role of risk factor changes in the decline of IHD mortality (Jackson & Beaglehole 1987, Sigfusson et al. 1991). The scarcity of such estimates reflects the shortage of available data, or its insufficiency for the proper analysis of this issue.

Finland's prominence in developing and testing preventive measures against cardiovascular disease stems from the fact that 20 years ago middle-aged Finnish men had the highest cardiovascular disease mortality in the world (Ovcarov & Bystova 1978).

This chapter assesses the degree to which the changes in the main coronary risk factors are able to account for the observed decline in IHD mortality and evaluates the relative importance of change in each risk factor. The information available to us offers a unique opportunity for such analyses, because mortality statistics, risk factor surveys and cohort studies provided the necessary standardized data on a clearly defined population over a 20-year period.

2. MATERIAL AND METHODS

Five cross-sectional population surveys (in 1972, 1977, 1982, 1987, and 1992) assessed the levels of coronary risk factors in North Karelia and Kuopio at five-year intervals. For each survey, an independent random sample was drawn from the national population register. The methods, numbers surveyed and the participation rates are presented in an earlier chapter.

Deaths with IHD (ICD 410–414, 8th revision) as the underlying cause of death in the national mortality statistics were linked to the survey cohort examined in 1972. Deaths occurring during 1972–1986 were included in the prospective follow-up. We used death from IHD as the outcome variable in the logistic regression models. Analyses were done separately for men and women. Age, baseline values of serum total cholesterol and diastolic blood pressure were included as continuous variables, and the smoking status was dichotomized. Socioeconomic factors (measured as years of education) or interactions between the risk factors were dropped from the analysis because they were not statistically significant in the logistic regression model after entering the classical risk factors. Moreover, including years of education in the model had very little effect on the odds ratios of the risk factors.

All these variables were available on 4243 men, of whom 303 had died of IHD, and on 4722 women, of whom 73 had died of IHD. The probability of death among men in the logistic regression model was $1/(1+\exp(12.73-0.108^{*}\text{age}-0.806^{*}\text{smoking}-0.021^{*}\text{diastolic blood pressure}-0.384^{*}\text{cholesterol}))$ and among women: $1/(1+\exp(14.90-0.104^{*}\text{age}-1.24^{*}\text{smoking}-0.0306^{*}\text{diastolic blood pressure}-0.365^{*}\text{cholesterol}))$. All the terms were statistically significant. We then calculated the average probability of an IHD death for each year the risk factor survey was done by entering the mean risk factor values observed in the survey into this logistic regression function. The relative importance of each risk factor was also estimated separately by changing in the logistic regression function only the value of that risk factor, while keeping the others unchanged according to the 1972 level. The percentage decline in predicted mortality compared to the 1972 level was then calculated for each survey year. The 95 % confidence interval (95 % CI) for this predicted decline in IHD mortality was calculated by

taking into account both the standard errors of risk factor levels in each survey and the standard errors of the parameter estimates in the logistic regression function.

Data on trends in IHD mortality were obtained from the National Mortality Register for men and women aged 35–64 years. Annual mortality was age standardized in five year age groups using Finland's 1972 population. The percentage decline in IHD mortality was calculated using the mean of the years 1969–72 as baseline. The 95 % confidence interval (95 % CI) for the observed decline was calculated using the Poisson distribution.

3. RESULTS

From 1972 to 1992 serum total cholesterol decreased by 13.0 % in men and 17.6 % in women. Diastolic blood pressure fell by 9.2 % and 13.3 % in men and women respectively. The prevalence of smoking declined among men from 53 % to 37 %, but rose among women from 11 % to 20 % (Table 19.1).

From 1969 to 1972 the mean of annual age standardized IHD mortality in men was 647 per 100.000 population, and this fell to 289 by 1992. In women the corresponding decrease was from 114 to 36 (Figure 19.1).

	1972		1977		1982		1987		1992	
	MEAN	SE	MEAN	SE	MEAN	SE	MEAN	SE	MEAN	SE
MEN										
CHOLESTEROL (mmol/l)	6,78	0.02	6.55	0.02	6.28	0.02	6.23	0.03	5.90	0.03
DIASTOLIC BLOOD PRESSURE (mmHg)	92.8	0.18	91.0	0.18	87.8	0.26	88.4	0.28	84.2	0.37
SMOKING (%)	53	0.8	47	0.8	42	1.0	39	1.2	37	1.5
WOMEN										
CHOLESTEROL (mmol/l)	6.72	0.02	6.36	0.02	6.10	0.03	5.94	0.03	5.54	0.03
DIASTOLIC BLOOD PRESSURE (mmHg)	91.8	0.19	87.6	0.17	84.6	0.25	83.5	0.26	79.6	0.33
SMOKING (%)	11	0.5	12	0.5	16	0.8	16	0.9	20	1.1

Table 19.1. Risk factor levels by year and gender.

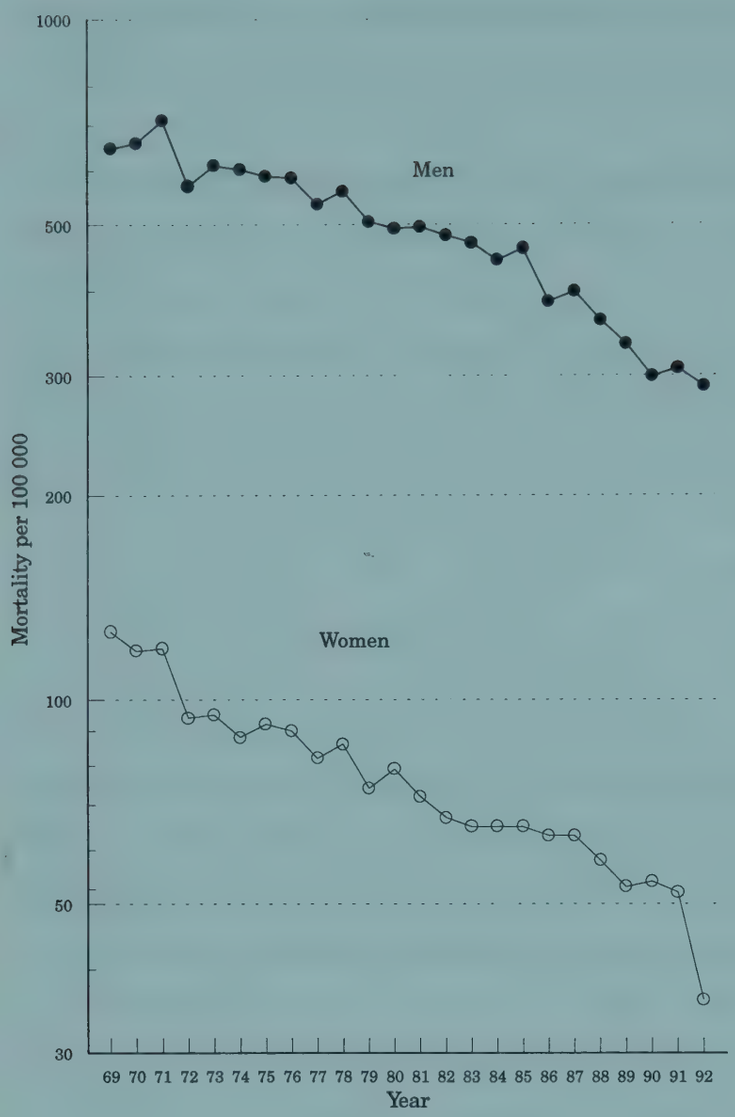

Figure 19.1. Age standardized ischemic heart disease mortality from 1969 to 1991 in men and women aged 35–64

Figure 19.2 shows the observed decline in IHD mortality according to the mortality statistics, and the predicted decline in mortality based on the logistic function and the observed risk factor changes in men from 1972 to 1992. In men, observed mortality decreased by 55 % (95 % CI 51–58) over the 20 years. The predicted decline, using the logistic regression model and the observed risk factor changes during the same period, was 44 % (95 % CI 37–50). Until the mid-1980s the trend in observed mortality followed the predicted decline, but subsequently it accelerated faster than had been predicted by the risk factor changes. The 95 % confidence intervals for the predicted decline in mortality included the observed decline until 1987 and 1992. The 95 % confidence intervals for the observed and predicted decline in IHD mortality did not overlap in the last survey year (Table 19.2).

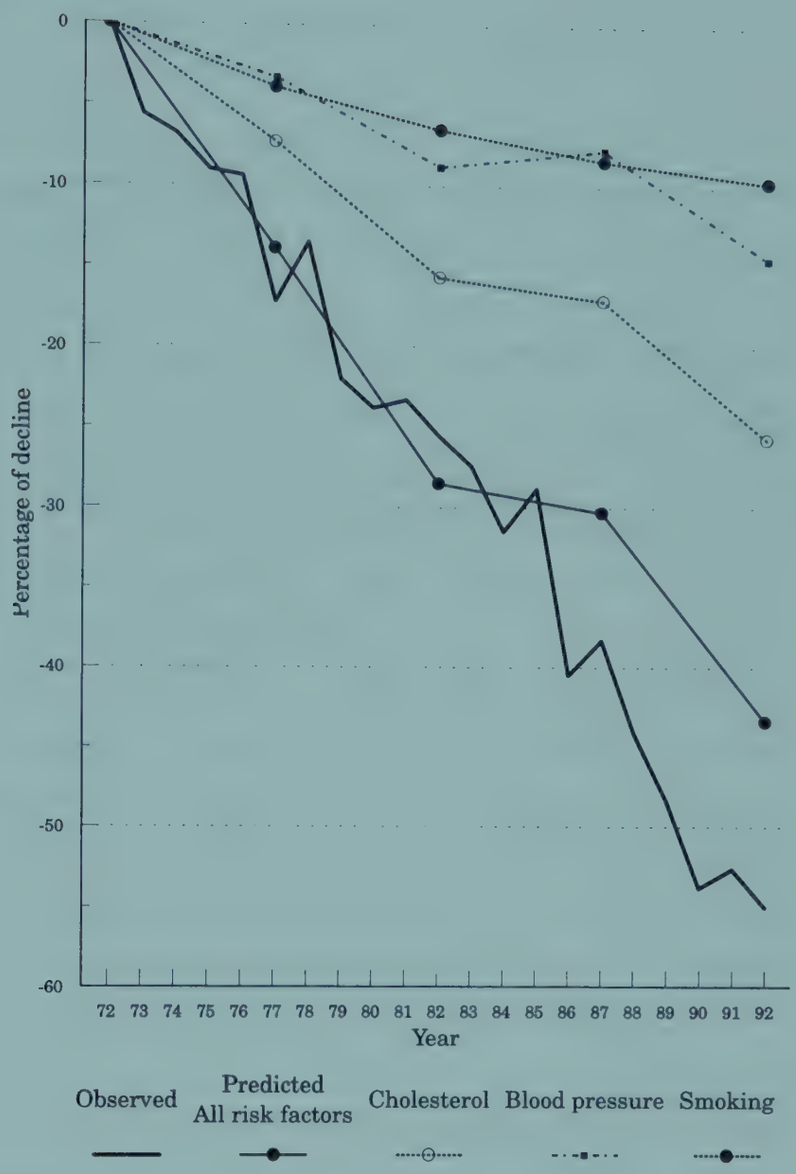

Figure 19.2. Observed and predicted decline in IHD mortality in men aged 35–64

	DECLINE IN MORTALITY (%)			
	OBSERVED	**95 % CI**	**PREDICTED**	**95 % CI**
MEN				
1972	0		0	
1977	17	12-22	14	10-17
1982	25	20-30	28	23-34
1987	38	33-42	30	25-36
1992	55	51-58	44	37-50
WOMEN				
1972	0		0	
1977	28	16-39	22	14-29
1982	41	31-51	32	21-42
1987	45	35-54	38	25-48
1992	68	61-74	49	37-59

Table 19.2. Observed and predicted decline (%) and 95% confidence intervals in IHD mortality from 1972 to 1992

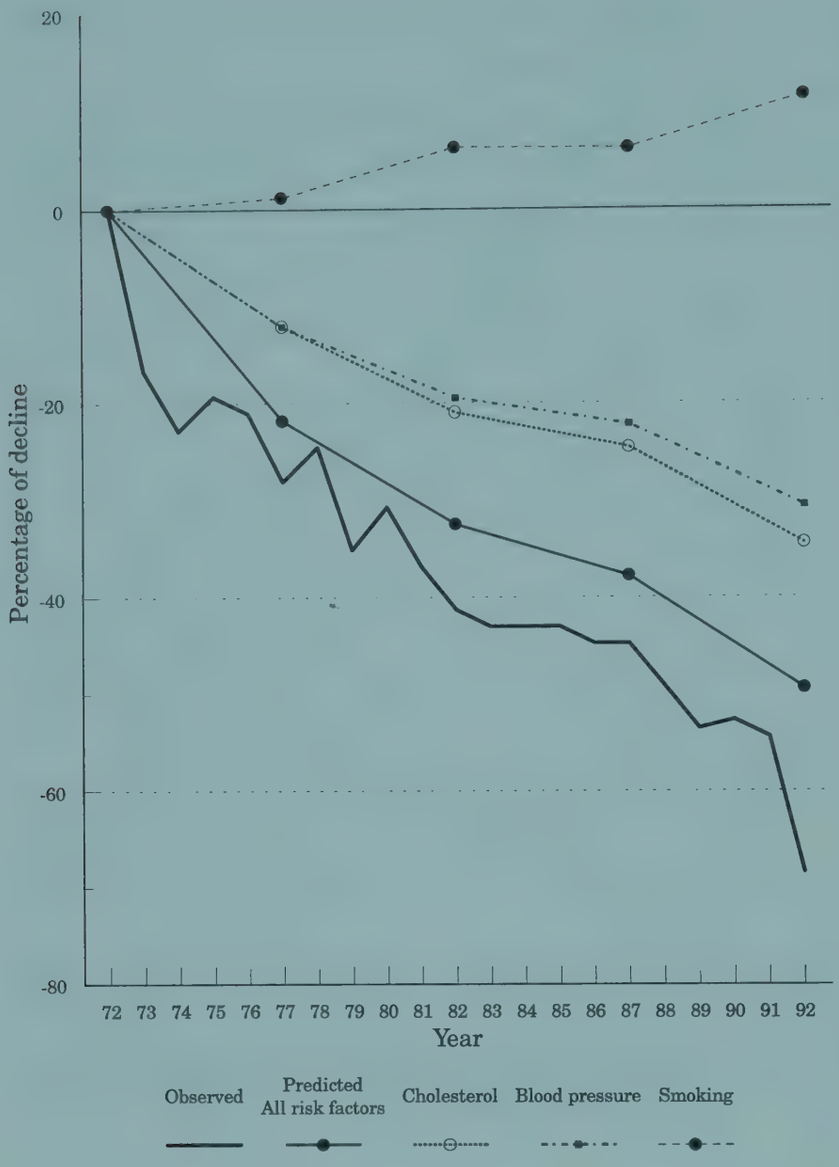

Figure 19.3. Observed and predicted decline in IHD mortality in women aged 35–64

To estimate the relative importance of each risk factor separately we computed three additional models. In men, the observed 13 % decrease in serum cholesterol predicted a 26 % decline in IHD mortality, the 9.2 % decrease in diastolic blood pressure predicted a 15 % decline, and the decrease in smoking from 53 % to 37 % predicted a 10 % decline in IHD mortality.

In women the observed IHD mortality fell by 68 % over the 20 years (Figure 19.3). The predicted decrease based on the risk factor changes was 49 % (95 % CI 37–59). Except in the last survey year of 1992, the 95 % confidence interval of the predicted mortality included 95 % CI of the observed change (Table 19.2). The 18 % decrease in cholesterol predicted a 35 % decline in IHD mortality, the 13 % decrease in diastolic blood pressure predicted a 31 % decline, and the increase in smoking from 11 % to 20 % predicted an 11 % increase in IHD mortality (Figure 19.3).

4. DISCUSSION

The well-standardized population surveys every five years from 1972 to 1992 and the high quality of mortality statistics in Finland provided us with a unique opportunity to estimate the role of risk factor changes in the actual decline in IHD mortality. The results showed that we could predict about 75 % of the decrease in IHD mortality by changes in the known risk factors among the men and women of the population. Almost half of the decline in IHD mortality was explained by the falling serum cholesterol level. Our results confirmed in the population the estimate derived from clinical trials (The Lipid Research Clinics Program 1984) that a 1 % decrease in serum cholesterol leads to a 2 % decline in IHD risk. The marked decrease in serum cholesterol is obviously a consequence of the substantial concurrent dietary changes in Finland (Nutrition Policy in Finland 1992, Pietinen 1990). Use of saturated fats (mainly milk fat) has decreased by one third from the early 1970s, while vegetable oil consumption has risen dramatically: in 1972, 90 % of people in eastern Finland used butter on bread but in 1992 only 10 %. Vegetable oil was very rarely used for cooking 20 years ago, but now 30 % of people use it regularly. Most people have switched from fatty milk to low fat or skim milk, and the annual per capita consumption of vegetables has risen from about 20 kg to 50 kg.

These findings show that the population approach strategy for the prevention of IHD in Finland has been successful. In 1972, the North Karelia project began as a national demonstration programme to reduce the highest coronary mortality rates in existence by lowering the major risk factors (Puska et al. 1985). Since the initial five year period the project has actively contributed to the nationwide preventive activities and strategies.

On the basis of our results, the risk factor changes seem to explain almost all of the developments in mortality in the 1970s. In the 1980s, the decline in mortality was faster than predicted by the observed changes in risk factors in the population. Improved treatment of acute AMI may be one explanation: thrombolytic treatment, coronary bypass surgery and prophylactic use of acetylsalicylic acid became widespread during the late 1980s. Secondary prevention in the form of risk factor counselling has also become common. The data from the North Karelian Myocardial Infarction Register indicate that the attack rate of recurrent my-

ocardial infarction declined more than the incidence of acute myocardial infarction during the late 1980s.

A comparison of trends such as the present analysis cannot exclude the possibility that the decline in both mortality and risk factors was caused by some third, unknown factor(s). Therefore, final conclusions on cause and effect cannot be drawn solely on the basis of these findings. Nevertheless, the consistency of the present results with those in the literature lends credit to the hypothesis that the observed decline in risk factors is causally associated with the decline in mortality.

It is possible that the logistic function based on a single baseline measurement underestimates the predictive power of the risk factors. If this is so the risk factor changes would explain even more of the mortality changes.

Data similar to these have been reported only from Iceland (Sigfusson et al. 1991), where the predicted decrease in risk, about 35 %, was close to the observed decline in IHD mortality. Other earlier studies have not been based on actual measurements of risk factors using a random population sample, but have used various kinds of indirect data for estimating risk factor trends to predict the mortality changes. Moreover, national mortality data rather than population-specific data have often been used.

In New Zealand, 38 % to 51 % of the observed decrease in IHD mortality could be accounted for by the calculated changes in serum cholesterol and tobacco consumption from 1968 to 1980 (Jackson & Beaglehole 1987). Estimated dietary changes were compatible with the rising mortality from ischemic heart disease from 1956 to 1970 in Japan (Ueshima et al. 1987), where the decrease in smoking and better control of hypertension might also have contributed to the declining IHD mortality between 1968 and 1978. In Australia the decrease in mortality has paralleled the favourable changes in nutrition and tobacco consumption (Al-Roomi et al. 1989). Reports from Italy are conflicting. One paper reported that IHD mortality started to decrease around 1978 even though the risk factor changes prior to that date were probably not favourable (Nicolosi et al 1988); another stated that a multivariate model including the main risk factors suggested a 10.5 % decrease in estimated coronary risk (research group ATS-RF2-OB43 of the Italian National Research Council, 1987).

A comparative ecological analysis of coronary heart disease mortality in Australia, USA, and England and Wales found a correlation between trends in risk factors and in coronary mortality (Dwyer & Hetzel 1980). In China the increase in IHD mortality seems to be associated with rises in cholesterol and blood pressure level (Tao et al. 1989). Results from a comparison between different age cohorts in the Framingham study were used to suggest that the improved cardiovascular risk factor profile may have contributed to a 60 % decrease in mortality from cardiovascular disease (Sytkowski et al. 1990).

With the mortality statistics, our main methodological problem was how to fix the baseline for the trend calculations. The annual variation in coronary mortality was quite large in the early 1970s. We decided to take the four-year mean from 1969 to 1972 to derive a sufficiently stable baseline estimate. 1969 was also the first year that the ICD 8 was used. The second area of uncertainty with the trend estimates concerned our ability to measure the risk factor changes from 1972 to 1992. For smoking, the comparability between our surveys is good. Smoking was assessed using the same questions in all the surveys. It is unlikely that self-reporting of smoking has changed substantially during the study years.

Regarding the blood pressure measurement, a short cuff was used in 1972 and 1977 and a longer one in 1982, 1987 and 1992. This may have led to overestimation of the decrease in blood pressure. Serum total cholesterol was determined by the Liebermann-Burchard reaction in 1972 and 1977 and by enzymatic assay from 1982. In our laboratory the Liebermann-Burchard reaction gave 2.4 % higher cholesterol values than the enzymatic method. We adjusted for this bias when we calculated the decrease in serum cholesterol. Overall, it may be that the true risk factor changes have in reality been slightly smaller than those we observed.

The predicted mortality in the present analysis was calculated from the measured risk factor levels without assuming any lag time. Results from cholesterol lowering trials suggest that the beneficial effects on mortality from cholesterol lowering begin to be seen after two years of treatment (Frick et al. 1987). However, it may be misleading to extrapolate the results from trials to population level studies because risk factors in a population change gradually, while in trials the risk factor level is lowered immediately at the beginning of the trial. The best way to estimate the lag time on a population level would be to have risk factor

measurements made while risk factor levels are increasing, and then also when they start to decline. Unfortunately, such data are not available. Also, in the present situation the observed and predicted mortality were on almost parallel declining trends, so assuming a lag time would not change the present results.

The result is dependent on the power of the chosen logistic regression model. To choose the variables for entry into the equation several models were tested. The classical risk factors were included in the model because the aim in both North Karelia and all Finland has been to reduce these risk factors. Socioeconomic factors measured as years of education did not affect the regression coefficients of the classical risk factors. Thus the predicted power of the model was about the same with or without years of education in the equation. The role of obesity was also tested in the model. This had no independent role in predicting IHD mortality and was thus left out. There has been an increase in body mass index in Finland over the last 20 years (Nutrition Policy in Finland 1992). Thus obesity can explain neither the change in risk factor levels nor the observed decline in IHD mortality.

In the present analysis a mean age of 55 years was included in the logistic function. Different ages give slightly different estimates. For instance, 45 years in the model gives a 40 % decline in the predicted mortality, 55 years gives a 43 % decline and 60 years a 41 % decline. Using the true individual values for age and other risk factors as obtained from the five risk factor surveys in the logistic regression function, the predicted decline in mortality was 39 % between 1972 and 1992. Thus the technical aspects of fitting the model had no meaningful effect on the magnitude of the trend estimate.

To estimate the role of statistical error on the predicted mortality we calculated the 95 % confidence interval. There are two types of statistical uncertainty affecting the calculations of predicted mortality decline. The first is the sampling error in the mean risk factor levels. As the sample sizes were large, these errors were relatively small. The confidence interval (95 %) was largest for smoking in the last survey in 1992 ($\pm$ 2.9) because the sample size was smallest then. For blood pressure and serum cholesterol the sampling error is similar or even smaller than the accuracy of measurement. Large statistical error arises from the standard error or the risk factor coefficients in the logistic regression model.

These errors are smaller among men than women because there were more deaths from IHD in men. Both of these errors were taken into account when calculating the confidence intervals. An alternative way to asses the stability of the predicted decline in IHD mortality is to take logistic regressions from different cohorts. In eastern Finland there are three different cohorts available: the present cohort based on the 1972 survey, the second cohort based on the 1977 survey, and the third one on the 1982 survey. Taking the logistic regression model from different cohorts, changing the follow-up time or pooling the cohorts together had no significant effect on predicted decline in IHD mortality. We decided to take the 1972 cohort, because the follow-up of the observed mortality began in that year.

We also calculated the 95 % confidence interval for the decline in observed mortality, assuming that deaths follow the Poisson distribution. Because the observed mortality was not estimated from a sample but includes all the deaths in the two provinces, it can be argued that the calculation of a confidence interval is not necessary, or may even be misleading since it increases the type II error probability when we are comparing the observed and predicted decline in IHD mortality. As the 95 % CIs for decline in observed mortality and for predicted mortality were not overlapping in the last survey, this suggests that mortality declined more than we are able to predict from the risk factors. The alternative way to approach the difference between the observed and predicted declines in mortality is to examine whether the confidence interval of the predicted value overlaps with the observed decline. In the last two surveys the predicted value no longer overlaps with the observed mortality, suggesting that in the late 80s and early 90s the mortality for IHD declined more than we could expect based on the changes in cardiovascular risk factors.

The risk factor levels decreased more in North Karelia than Kuopio during the first five years, since when the trends have been similar (Vartiainen et al. 1991). The trends in mortality in the 1970s and early 80s were published earlier (Salonen et al. 1979, Vartiainen et al. 1991). The differences between the provinces have been relatively small compared to the overall decline. To achieve more stability in the analyses we pooled together the two areas. In the whole of Finland the decrease in IHD mortality was about 50 % from 1970 to 1991. Finland has a small,

homogeneous population and the socioeconomic variations across the country are relatively minor. It is likely that the two areas we have studied are fairly representive of the developments in the whole country. The WHO coordinated MONICA project (WHO Monica Project 1988) will enable better assessment of the role of changing risk factors in coronary heart disease trends, incidence and mortality in different populations.

In summary, the observed changes in the risk factors in the population from 1972 to 1992 predicted a 43 % decline in IHD mortality to occur in men and a 49 % decline in women. In fact, the observed decline in IHD mortality was 55 % in men and 68 % in women. It is thus concluded that most of the observed decline in IHD mortality can be explained by changes in the three risk factors targeted.

REFERENCES

Al-Roomi KA, Dobson AJ, Hall E, Heller RF, Magnus P. Declining mortality from ischemic heart disease and cerebrovascular disease in Australia. Am J Epidemiol 1989;3:503–510.

Dwyer T, Hetzel BS. A comparison of trends of coronary heart disease mortality in Australia, USA and England and Wales with reference to three major risk factors – hypertension, cigarette smoking and diet. Int J of Epidemiol 1980;1:65–71.

Frick MH, Elo O, Haapa K, Heinonen OP, Heinsalmi P, Helo P et al. Helsinki Heart Study: primary prevention trial with gemfibrozil in middle-agegd men with dyslipidemia: safety of treatment, changes in risk factors, and incidence of coronary heart disease. N Engl J Med 1987;317:1237–45.

Jackson R, Beaglehole R. Trends in dietary fat and cigarette smoking and the decline in coronary heart disease in New Zealand. Int J Epidemiol 1987;3:377–382.

The Lipid Research Clinics Program: The Lipid Research Clinics Coronary Primary Prevention Trial Results. II. The Relationship of Reduction in Incidence of Coronary Heart Disease to Cholesterol Lowering. JAMA 1984;251:365–374.

Nicolosi A, Casati S, Taioli E, Polli E. Death from cardiovascular disease in Italy, 1972–1981: Decline in mortality rates and possible causes. Int J Epidemiol 1988;4:766–772.

Nutrition Policy in Finland. National Nutrition Council. Ministry of Agriculture and Forestry, publications 1992:11. Helsinki, Helsinki University Printing House, 1992. 64 pages.

Ovcarov V., Bystrova V. Present trends in mortality in the age group 35–64 in selected developed countries between 1950–1973. World Health Stat Q 1978;31:208.

Pietinen P. Changing dietary habits in the population: The Finnish experience. In: Lipids and Health (Ed. G. Ziant), Elsevier Science Publishers B.V. 1990.

Puska P, Nissinen A, Tuomilehto J, Salonen JT, Koskela K, McAlister A et al. The community-based strategy to prevent coronary heart disease: Conclusions from the ten years of the North Karelia project. Ann Rev Public Health 1985;6:147–93.

The research group ATS-RF2-OB43 of the Italian National Research Council. Time trends of some cardiovascular risk factors in Italy. Am J Epidemiol 1987;1:95–103.

Salonen JT, Puska P, Mustaniemi H. Changes in morbidity and mortality during a comprehensive community program to control cardiovascular disease during 1972–7 in North Karelia. Br Med J 1979;2:1178–83.

Sigfusson N, Sigvaldason H, Steingrimsdottir L, Gudmundsdottir II, Stefansdottir I, Thorsteinsson T, Sigurdsson G. Decline in ischaemic heart disease in Iceland and change in risk factor levels. BMJ 1991;302:1371–1375.

Sytkowski PA, Kannel WB, D'Agostino RB. Changes in risk factors and the decline in mortality from cardiovascular disease. N Engl J Med 1990;23:1635–1641.

Tao S, Huang Z, Wu X, Zhou B, Xiao Z, Hao J, Li Y, Cen R, Rao X. CHD and its risk factors in the People's Republic of China. Int J Epidemiol 1989;3:S159–S163.

Tuomilehto, Geboers J, Salonen JT, Nissinen A, Kuulasmaa K, Puska P. Decline in cardiovascular mortality in North Karelia and in other parts of Finland. Br Med J 1986;293:1068–71.

Uemura K, Pisa Z. Recent trends in cardiovascular disease mortality in 27 industrialized countries. World Health Stat Q 1985;38:142–162.

Ueshima H, Tatara K, Asakura, S. Declining mortality from ischemic heart disease and changes in coronary risk factors in Japan, 1956–1980. Am J Epidemiol 1987;1:62–72.

Vartiainen E, Korhonen HJ, Pietinen P, Tuomilehto J, Kartovaara L, Nissinen A, Puska P. 15-year trends in coronary risk factors in Finland, with special reference to North Karelia. Int J of Epidemiology 1991;20:651–662.

WHO MONICA Project (prepared by Tunstall-Pedoe H.). The World Health Organization MONICA Project (monitoring trends and determinants in cardiovascular disease): major international collaboration. J Clin Epidemiol 1988;41:105–114.

20. THE COST OF CARDIOVASCULAR DISEASES

Urpo Kiiskinen

1. INTRODUCTION

The remarkable decline in CVD mortality and morbidity since the early 1970s has definitely had a substantial economic impact on Finnish society. The data available to us do not permit a full- scale economic evaluation, including analysis of cost-effectiveness or cost-benefit, which would define the economic efficiency of the preventive activities undertaken in the framework of the North Karelia Project. This chapter focuses instead on the changes in the economic impact of CVD over the past 20 years. Using the standard cost-of-illness methodology, the annual costs imposed by CVD on society as a whole were estimated for the years 1972, 1977, 1982, 1987 and 1992.

2. METHODOLOGY

Costs associated with certain forms of illness are typically divided into three categories; direct, indirect and intangible costs. Direct costs are the value of health service resources devoted to the disease. This item includes the actual expenditures on hospitalization, outpatient care, drug therapy, rehabilitation, and the like. Indirect costs are derived from the time lost from activities in which an individual would have participated while in a normal state of health. Indirect costs are generally assumed to equal the value of output lost due to premature death or to the reduced productivity caused by the illness (Hodgson and Meiners 1982, Max et al. 1990).

The category of intangible costs is made up of the non-economic consequences of illness. The "pain, grief and suffering" experienced by

the patient, family and friends because of his/her morbidity or death undoubtedly diminish the welfare of those involved, and must therefore be considered as the real social costs of illness. However, although they constitute a genuine and potentially large component of total costs, these intangible factors are omitted from this study because of the considerable difficulties in measuring and assigning values to them.

2.1. Prevalence and incidence-based costs

Two approaches can be used to estimate the cost-of-illness. In the prevalence approach, both the direct and indirect costs resulting from disease are assigned to the years in which they are borne. The value of expected future production losses caused by premature mortality are assigned to the year of death. The prevalence approach provides an estimate of economic burden for a period of time (usually a year) imposed by the prevalence of the disease during the same period (Max et al. 1990, Hartunian et al. 1981).

The incidence approach provides an estimate of lifetime costs-of-illness. The rationale of this approach is that the lifetime stream of costs associated with an illness should be assigned to the year of onset of a disease. Information on the incident population is combined with knowledge of the likely course of an illness and the costs at each stage of it (Max et al., 1990, Hartunian et al. 1981).

Since this study focuses on the aggregated category consisting of diseases with diverse prognosis and needs for medical care, it is impossible to meet the data requirements of incidence-based costing. This study is therefore based on the prevalence approach.

2.2. Direct costs

Estimation of the direct costs of CVD was limited by the insufficiency of regional statistics stretching 20 years back in time. Thus only the three most important components of total direct cost – the costs of hospitalization, outpatient care and drug therapy of CVD patients – were included in the analysis. The estimation procedures and data sources for each direct cost item are described in brief.

Hospital inpatient care

The costs of hospital bed-day by diagnosis were not available for the estimation of hospitalization costs generated by CVD. It is unlikely that the cost of a CVD-related bed-day would equal the average cost. It also appeared that reliable data on the average cost per day both by type of hospital and by specialty were not available for all the years under analysis. Therefore, the average unit cost by type of hospital was used as a proxy. Hospitals were split into three categories, in which the costs clearly differed from one type to another: university hospitals, health centre wards and other general hospitals.

In order to capture the full resource cost of one day of hospitalization, the capital costs must be included in the calculation. The relative magnitude of the capital costs for each category of hospital was estimated as the ratio of total annual capital costs to operating costs (Sairaalaliitto 1991, Suomen Kaupunkiliitto 1992). The operating cost per bed-day was increased by this ratio.

Regional data on the number of CVD-related hospital bed-days by type of hospital were obtained from the hospital discharge register (STAKES 1993). Patient days spent in mental care institutions or in the psychiatric specialty unit of a hospital with a CVD diagnosis were omitted from the data, since in most cases the original reason for hospitalization was mental disorders. Furthermore, as these hospitalization periods were markedly longer than the average stay due to CVD they would have been a potential source of bias.

Outpatient care

The number of visits to physicians is based on the health centre utilization survey conducted during 1989 and 1990 (Aro 1991). This survey indicated that 7.7 % of all visits to health centre physicians were made because of CVD. It was assumed that CVD patients accounted for the same proportion of visits to general hospital outpatient departments. Total numbers of visits and their respective average costs were obtained from hospital and health centre statistics (Suomen Kuntaliitto 1993, Suomen Kaupunkiliitto 1992).

The capital costs were added to operating unit costs in the manner previously outlined. The average cost of a visit to a health centre is a rough estimate based on the total number of visits – not only to doctors

but also to nurses and laboratory and X-ray examinations etc. It was therefore assumed that the proportion of CVD-related visits to physicians also applied to these other types of visit; dental appointments were excluded from the total visits.

The total cost of CVD outpatient care was allocated to age groups, genders and regions on the basis of the numbers of persons entitled to reimbursement of CVD drug expenses by the Social Insurance Institution (SII) (see next section).

Drugs

The costs of CVD drug therapy were derived from the Finnish statistics on medicines (Lääkelaitos 1993, Nordic Council on Medicines 1993). Since the monetary value of drugs recorded in the statistics is based on pharmacies' purchase prices, i.e. wholesale prices, it underestimates the actual resource costs of drug therapy by the retail portion of costs. In order to arrive at the full costs (approximated by the retail price) of CVD-related drug consumption, an adjustment multiplier of 1,7 for 1992 and 1,6 for earlier years of the study was introduced (estimate provided by the National Agency for Medicines). For the purposes of this study only the sales to pharmacies were accepted, because the value of hospital sales was already covered by the average cost of a hospital bed-day; the inclusion of that portion of the drug costs would have lead to double counting.

During the study period most drugs used for treating CVD were subject to preferential reimbursement within the national sickness insurance scheme. The number of diseases comprehensively covered in this way has increased from two in 1972 to four in 1992. The total value of drug usage is allocated by age group, gender and region on the basis of the distribution of recipients of SII refunds for CVD drug therapy costs.

2.3. Indirect costs

According to the human capital approach the indirect costs consist of the value of the reduced productivity of persons suffering from CVD. The most important factor is the time lost from work. In this study the estimates for the duration of reduced productivity were derived from the information on sickness absence, disability pensions and premature deaths. However, time lost from work is not the only potential source of

indirect costs. Reduction in productivity may also occur if illness lessens the productivity of persons while on the job, and this, in addition to absenteeism, may also have adverse effects on the productivity of co-workers. Furthermore, the value of leisure time activities lost due to CVD is an indirect cost, which can be of major importance to persons without market earnings, such as young children, housewives and retired persons. However, lack of data prevents us from estimating indirect costs other than the value of lost working time.

The indirect costs of CVD were estimated using the human capital approach, which is based on the assumption that earnings reflect the individual's productivity. In that sense, the value of the individual's output is equal to the maximum amount the employer is willing to pay in the form of salaries and related costs for his/her labour input. This controversial assumption is of crucial importance in human capital theory. The annual value of an individual's output was calculated using the age and sex specific annual gross income (Tilastokeskus 1993a, 1993b), adjusted for employers contribution to social security schemes and operating surplus (Tilastokeskus 1993c).

Sickness absence

The working time lost due to CVD was estimated on the basis of the sex and age-specific sickness allowance statistics of the Social Insurance Institution (Kansaneläkelaitos 1993a). Sickness allowance is paid for six days per week after a waiting period of seven working days, not counting the day on which incapacity began. Since a normal week has only five working days, 5/6 of the days covered by the sickness insurance are working days. The number of covered days was increased by 7.5 days times the number of sickness allowance spells in order to include the uncovered waiting period in the total absence days. The number of work loss years is approximated by assuming 220 working days per year.

Thus the value of production lost due to CVD-related sickness absence is simply the number of lost working years multiplied by the mean value of an individual's annual production. The estimate for the lost working time due to CVD-related sickness absence is an underestimate, because of absence periods shorter than the uncovered waiting period. It is also possible that in some cases the sickness allowance is not requested in the first place.

Disability pensions

The value of production lost due to CVD-related disability pensions was estimated using the disease-, age-, sex- and province-specific data provided by SII (Kansaneläkelaitos 1993b). The average number of disability pensions at the end of the year under analysis and the preceding year was used as an approximation of the lost labour input in years.

In estimating the value of potential production lost due to CVD-related disability pensions, account was taken of the individual's likelihood of being employed if the CVD had not occurred (Tilastokeskus 1992). This adjustment was made to eliminate the effect of unemployment and labour force participation rates on the results (Pekurinen 1991). Since reliable regional labour statistics were not available, probabilities were assumed to be constant over all the provinces of Finland.

Premature deaths

The estimates for working years and potential production lost because of premature deaths caused by the CVD were based on the standard procedure for calculating the expected number of life years lost. The expected number of working years lost before the age of 65 was estimated on the basis of survival probabilities and the number of deaths from CVD. Survival probabilities by age, sex and cause of death were obtained from life tables published by Statistics Finland (Tilastokeskus 1993f), and the number of CVD-deaths from the statistics on causes of death (Tilastokeskus 1993e).

The present value of an individual's life-time production was estimated by discounting the expected value of future years' production to its present value taking into account the survival probability (risk of CVD death removed), the probability of being employed and the anticipated increase in productivity. A discount rate of 5% and a productivity growth rate of 2% per annum were used for the present value computation.

3. RESULTS

The costs of CVD were inflated to the 1992 price level (Tilastokeskus 1993d) and then converted to US dollars using an exchange rate of 1 USD = 5,5 FIM. The costs are shown separately for both genders and

two age groups: 35–64 years (representing the adult, working-age population), and 65 or older, (representing the retired elderly population).

3.1. Direct costs

In addition to the monetary cost of CVD-related hospital inpatient care, the magnitude of hospital utilization is demonstrated in terms of hospitalization periods and bed-days (Table 20.1).

The number of hospitalizations of North Karelians aged 35 to 64 increased in the 1970s and early 1980s, but has since been on the decrease. The figure for men in all Finland has clearly grown, but for women has slightly fallen. The statistics for the elderly population inevitably indicate an increasing amount of CVD-related hospitalizations for both sexes in the regions analysed.

The number of days spent in hospital by 35–64-year-old men rose over the first five-year-period, but has been falling ever since. Among women this figure has declined over the entire study period. There were some fluctuations among the elderly, but overall there was a clear increase in numbers of bed-days from 1972 to 1990.

Year	Number of hospitalization periods				Number of bed-days				Cost of hospitalization (USD million)			
	35-64		65+		35-64		65+		35-64		65+	
	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland
Men												
1972	1 200	24 300	1 100	26 000	11 000	292 000	13 000	494 000	1.2	35.9	1.5	55.1
1977	1 600	28 800	1 100	24 000	14 000	356 000	25 000	543 000	2.0	59.6	3.0	77.1
1982	1 600	30 100	1 700	31 300	13 000	306 000	31 000	708 000	2.3	56.6	4.6	106.4
1987	1 700	36 100	1 700	37 600	13 000	297 000	37 000	693 000	3.0	75.3	5.6	122.7
1990	1 600	35 300	2 000	40 500	12 000	276 000	33 000	876 000	3.4	81.3	6.2	184.9
Women												
1972	900	23 700	1 300	35 200	14 000	242 000	22 000	870 000	1.7	29.1	2.3	93.5
1977	1 200	24 700	1 400	34 300	9 000	215 000	41 000	1 098 000	1.4	34.7	4.7	142.0
1982	1 300	22 900	2 300	46 000	8 000	178 000	105 000	1 777 000	1.3	33.6	12.3	245.9
1987	1 000	23 500	2 600	57 100	6 000	161 000	87 000	1 575 000	1.5	39.8	12.3	258.0
1990	900	21 400	2 700	59 500	6 000	148 000	82 000	2 003 000	1.7	41.2	13.6	365.4

Table 20.1. Number of CVD-related hospitalizations, bed-days and the cost of hospital inpatient care in Finland.

The cost of CVD hospitalization among the working age population has tended to rise since 1972, and among the elderly has more than tripled over the study period.

The cost of CVD-related outpatient care has been estimated only for 1991, due to the lack of reliable data. Rough estimates for 1991 are presented to give an idea of the relative importance of outpatient service utilization in calculations of the total economic burden of CVD. As seen in the estimates given in Table 20.5, the cost of CVD-related visits to outpatient departments was about 150 million dollars in 1991 (1992 prices).

Reliable statistics on medicine sales have been available since 1978 only. Changes in classification may have had some minor effects on the comparability of the results from different years. The total costs of drug therapy, as estimated in this study, have expanded from 110 million dollars in 1978 to about 180 million dollars in 1992. Table 20.2 shows the development of costs by gender and age-group. Since 1982 the cost estimates for all categories in Table 20.2 have had a rising trend. The consumption of drugs (in monetary terms) in 1992 was on a clearly higher level in most age-sex categories than back in 1978.

Year	Cost of CVD drug therapy (USD million)			
	35–64		65+	
	North Karelia	All Finland	North Karelia	All Finland
Men				
1978	1.1	20.8	0.6	14.1
1982	1.0	20.7	0.6	16.0
1987	1.4	29.1	1.0	24.4
1992	1.9	39.1	1.6	36.5
Women				
1978	1.7	32.8	1.9	43.9
1982	1.2	26.5	1.9	26.1
1987	1.2	27.5	2.4	57.3
1992	1.4	32.9	3.1	71.5

Table 20.2. The estimated costs of CVD drug therapy in Finland (USD million)

3.2. Indirect costs

The indirect economic consequences of CVD are presented, using both the number of potential working years lost (Table 20.3) and the monetary value of lost production (Table 20.4).

Year	Number of expected working (prior to 65 years of age) years lost							
	Sickness absence		Disability pensions		Premature mortality		Total	
	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland
Men								
1972	466	6 900	2 196	27 962	2 181	41 335	4 843	76 197
1977	159	4 632	2 291	34 807	1 916	39 612	4 366	79 051
1982	136	4 202	1 765	29 350	1 635	33 155	3 536	66 707
1987	163	3 550	1 520	27 967	1 636	28 160	3 319	59 677
1992	142	3 621	1 455	26 957	1 100	25 193	2 697	55 771
Women								
1972	594	8 802	1 440	21 505	730	12 323	2 764	42 630
1977	139	3 994	1 756	29 041	392	10 336	2 287	43 371
1982	140	3 159	1 127	20 586	278	8 001	1 545	31 746
1987	58	2 321	762	15 818	220	7 673	1 040	25 812
1992	86	1 834	623	13 664	283	5 990	992	21 488

Table 20.3. The estimated number of years lost from work due to CVD in Finland

Year	Value of lost working time (USD million)							
	Sickness absence		Disability pensions		Premature mortality		Total	
	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland
Men								
1972	13.8	205.1	51.8	724.0	43.6	906.5	109.1	1 835.6
1977	4.7	146.5	48.2	802.9	33.9	770.1	86.7	1 719.5
1982	4.7	150.5	41.2	741.0	31.9	704.4	77.8	1 595.8
1987	6.1	142.5	32.9	672.1	31.2	602.3	70.2	1 416.9
1992	5.8	159.4	30.9	605.6	21.0	529.0	57.7	1 294.0
Women								
1972	11.2	166.9	13.8	221.9	6.1	112.7	31.1	501.5
1977	2.6	81.0	16.3	300.0	3.3	94.8	22.2	475.8
1982	3.0	71.0	11.5	229.8	2.6	84.2	17.1	385.0
1987	1.5	63.9	8.1	191.7	2.2	90.4	11.8	346.1
1992	2.5	57.5	7.2	172.0	3.5	79.3	13.2	308.8

Table 20.4. The value of potential production lost due to CVD in Finland

Among 35–64-year-old men disability pensions and premature deaths have been almost equally important causes of lost working years. Short term absence from work as sickness leave due to CVD has accounted for less than 10 % of total work loss time. The total number of male working years lost has declined by 45 % in North Karelia, while the downward trend nationwide has been 25%.

Among women, the significance of early death as the cause of lost working years has been modest by comparison. In 1992 early death accounted for less than 30 % of the total years of lost female labour potential, with another approximately two-thirds due to disability pensions. Among women the total years lost from work has fallen by 65 % in North Karelia since 1972, while the concurrent average decline in all Finland has been 50 %.

The estimated value of potential production lost due to CVD is reported in Table 20.4. The difference in the monetary value of lost productivity between men and women was greater than the difference in the expected number of working years lost. This can be explained partly by the higher annual earnings of men and partly by the lower labour force participation rate of women. In 1992 the total indirect cost of CVD in Finland was approximately 1.6 billion dollars.

4. COST SUMMARY AND DISCUSSION

Although the cost estimates presented here do not include all the elements of social cost, they certainly represent the main tangible cost items incurred by CVD. Most cost elements are accurately estimated as a whole, but many assumptions had to be made for the age, sex, and regional distributions.

The breakdown of the social costs related to CVD in 1992 is presented in Table 20.5, both in total and per capita terms. It can be seen that the value of indirect consequences of CVD is of dominant economic importance among working age individuals. After including the CVD-related costs among the elderly, the proportion of direct costs climbs steeply. Among women in particular, retired persons included, the cost of hospital inpatient care rises almost ten-fold to become the most significant item in the total costs.

Year 1992	Persons aged 35 to 64						Persons aged 35 or more					
	USD million		USD per capita		%		USD million		USD per capita		%	
	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland
Men												
– Hospitalization *	3.4	81.3	94	83	5.3	5.6	9.6	266.2	212	219	13.1	15.6
– Outpatient care **	1.5	31.7	42	32	2.3	2.2	2.8	61.2	62	50	3.8	3.6
– Medicines	1.9	39.1	52	40	2.9	2.7	3.5	75.6	76	62	4.7	4.5
Total direct	6.8	152.1	188	155	10.5	10.5	15.9	403.0	350	331	21.6	23.7
– Sickness absence	5.8	159.4	162	163	9.0	11.0	5.8	159.4	129	131	7.9	9.4
– Disability pensions	30.9	605.6	863	620	48.0	41.9	30.9	605.6	683	497	42.0	35.7
– Mortality	21.0	529.0	585	541	32.5	36.6	21.0	529.0	463	434	28.5	31.2
Total indirect	57.7	1 294.0	1 610	1 324	89.5	89.5	57.7	1 294.0	1 275	1 062	78.4	76.3
TOTAL	64.4	1 446.1	1 798	1 479	100.0	100.0	73.5	1 697.0	1 625	1 393	100.0	100.0
Women												
– Hospitalization *	1.7	41.2	48	42	9.4	10.1	15.3	406.6	309	288	41.7	44.0
– Outpatient care **	1.1	26.6	34	27	6.5	6.5	3.6	84.7	73	60	9.9	9.4
– Medicines	1.4	32.9	42	34	8.0	8.0	4.5	104.4	90	74	12.3	11.5
Total direct	4.2	100.7	124	103	23.9	24.6	23.4	595.7	472	422	63.9	65.9
– Sickness absence	2.5	57.5	75	59	14.4	14.1	2.5	57.5	50	41	6.8	6.4
– Disability pensions	7.2	172.0	215	175	41.4	41.9	7.2	172.0	145	121	19.7	19.0
– Mortality	3.5	79.3	105	81	20.3	19.4	3.5	79.3	71	56	9.6	8.7
Total indirect	13.2	308.8	395	315	76.1	75.4	13.2	308.8	266	218	36.1	34.1
TOTAL	17.4	409.5	519	418	100.0	100.0	36.6	904.5	738	640	100.0	100.0

* Based on 1990 utilization rates
** Based on 1991 utilization rates

Table 20.5. Main items of social costs generated by CVD in Finland in 1992

The percentage changes in CVD-related costs from 1972 to 1992 are presented in Table 20.6. Setting 1972 as base year for the comparison is quite problematic, since the only disease-specific direct cost item available was the cost of hospitalization. However, in order to facilitate a robust comparison of costs 20 years ago and in 1992, an approximation of CVD-related drug costs in 1972 was produced. This was achieved simply by adjusting the 1978 figure for CVD drug costs by the change in total medicine expenditure from 1972 to 1978 (Kansaneläkelaitos 1993c).

Furthermore, the significant reform of municipal health care which accompanied the introduction of The Primary Health Care Act in 1972, and the consequent foundation of state-supported health centres, enhanced the supply of health services (Häkkinen 1988, Kalimo et al. 1982), and may thus have reduced the comparability of health service usage in

Gender/ type of cost	Persons aged 35 to 64				Persons aged 35 or more			
	North Karelia		All Finland		North Karelia		All Finland	
	USD mill.		USD mill.		USD mill.		USD mill.	
Men								
Change in:								
– Direct costs	4.0	144 %	83.8	123 %	10.7	207 %	258.2	178 %
– Indirect	–51.4	–47 %	–541.6	–30 %	–51.4	–47 %	–541.6	–30 %
costs	–47.4	–42 %	–457.8	–24 %	–40.7	–36 %	–283.4	–14 %
Total costs								
Women								
Change in:								
– Direct costs	–0.2	–4 %	22.2	28 %	14.5	162 %	367.7	161 %
– Indirect	–17.9	–58 %	–192.8	–38 %	–17.9	–58 %	–192.7	–38 %
costs	–18.1	–51 %	–170.6	–29 %	–3.4	–9 %	175.0	24 %
Total costs								
Both sexes								
Change in:								
– Direct costs	3.8	54 %	106.0	72 %	25.2	179 %	625.9	168 %
– Indirect	–69.3	–49 %	–734.4	–31 %	–69.3	–49 %	–734.3	–31 %
costs	–65.5	–45 %	–628.4	–25 %	–44.1	–29 %	–108.4	–4 %
Total costs								

Table 20.6. The change in CVD-related social costs from 1972 to 1992 by gender and by the type of costs

the early 70s to the corresponding figures of most recent years. On the other hand, as noted above, the relative magnitude of direct costs is quite modest, and therefore the change in total costs over two decades is not very sensitive to possible error in direct costs.

A typical development pattern in the costs of CVD over the past 20 years is rising direct costs, i.e. medical expenditure, resulting from the expanding quantity and quality of resources devoted to CVD-patients. On the other hand, the decrease in indirect cost, resulting from the favourable development in CVD mortality and morbidity, has been big enough to outweigh the rise in direct costs. The proportional decrease in CVD-related total costs ranged from about 5 to 50 % and was clearly greater in North Karelia than all Finland on average. Despite this, Table 20.5 indicates that the costs per capita are still somewhat higher in North Karelia.

Table 20.1 shows that hospital costs have more than doubled among the working age male population. This is quite a surprising outcome, because simultaneously both the mortality and incidence rates for heart

attack and stroke have fallen drastically. There is a two-stage possible explanation. Firstly, the unit cost of hospital treatment has increased at a faster rate than the cost of living in general. The real cost per bed-day has more than doubled in university and other general hospitals over the study period, while the respective increase in health centre wards has been 40%. Apparently, the vast majority of CVD episodes experienced by working age citizens have been treated in university or other general hospitals.

Secondly, the declining incidence of acute myocardial infarction (AMI) and stroke has not necessarily been mirrored by a decline in other CVD events, and hence the resources previously tied up in the treatment of AMI and stroke have been freed for the less severe CVD cases. The recent findings of Pyörälä et al. (1994) support this explanation. Their study found that the number of hospital treatment days due to an AMI diagnosis (ICD code 410) among Finns younger than 65 decreased between 1981 and 1990, but that the number of treatment days associated with other coronary heart disease diagnoses (ICD codes 411–414) increased (Pyörälä et al. 1994). Furthermore, the fall in the number of lost working years reported in Table 20.3 above is a strong indicator of a decrease in either the prevalence or severity of CVD, or both.

It should also be kept in mind that the overall expenditure on general hospitals and medicines has risen by around 150 % over the 20 years (Kansaneläkelaitos 1993c). This is somewhat more than the increase in direct health care costs related to CVD among persons aged 35 to 64, but slightly less than the corresponding figures when the elderly are also taken into account (Table 20.6).

The cost of CVD-related outpatient care was estimated accurately only for 1992. In order to allow for its influence in total cost calculations, it was assumed to have changed at the same rate as the sum of CVD costs due to hospital care and drug therapy. In fact, the cost of outpatient care was not of crucial importance in the cost calculation and the assumption made above was not expected to cause any major bias to the results reported in Table 20.6. However, to support that conclusion, sensitivity analysis was performed assuming the cost of outpatient care in 1992 to be as presented in Table 20.5, and the corresponding figures in 1972 to be zero. The effect on the total cost was generally from one to three percentage points and none of the signs were reversed. It was

also noted that allowing for population changes would lead to an even greater decrease in costs, and would also narrow the difference between change rates in North Karelia and the whole country.

On the basis of the facts presented above, it can be concluded that the social costs generated by CVD are likely to have declined since 1972, especially in terms of cost per capita. According to the change rates presented in Table 20.6, the decreases in annual costs in all Finland have been about 100 and 600 million US dollars for persons over 35 and 35-64 years of age respectively, and in North Karelia 40 and 60 million US dollars, respectively. It can also be seen that the estimated proportional reduction in costs was greater in North Karelia than in all Finland. This could translate as a 35 million US dollar saving in 1992 alone for the province of North Karelia, although this must necessarily be regarded as a crude estimate, as explained above.

REFERENCES

Aro S (Toim.), 1991. VPK väestövastuisen perusterveydenhuollon kokeilut. Sosiaali- ja Terveyshallitus. Raportteja 24/1991. VAPK-Kustannus, Helsinki.

The Finnish Committee on Drug Information and Statistics 1989. Finnish statistics on medicines 1988. Helsinki.

Hartunian NS, Smart CN, Thompson MS 1981. The incidence and economic costs of major health impairments. A comparative analysis of cancer, motor vehicle injuries, coronary heart disease and stroke. Lexington, MA: Lexington Books.

Hodgson TA, Meiners MR 1982. Cost-of-illness methodology: a guide to current practices and procedures. Milbank Quarterly 1982;60:429–462.

Häkkinen U. Terveyspalvelujen kustannukset, rahoitus ja hinnat Suomessa vuosina 1960–1985 (Cost, financing and prices of health care in Finland 1960–1985). Kansaneläkelaitoksen julkaisuja M: 65. Helsinki 1988.

Kalimo E, Nyman K, Klaukka T, Tuomikoski H, Savolainen E. Terveyspalvelusten tarve, käyttö ja kustannukset vuosina 1964-1976 (Need, use and expenses of health services in Finland 1964–1976). Kansaneläkelaitoksen julkaisuja A:18. Helsinki 1982.

Kansaneläkelaitos (Social Insurance Institution). Data on national sickness insurance refunds on medicine expenses and sickness allowances 1972–1992. Helsinki 1993a.

Kansaneläkelaitos (Social Insurance Institution). Unpublished data on disability pensions for years 1971–1992 provided by the Social Insurance Institution. Helsinki 1993b.

Kansaneläkelaitos (Social Insurance Institution). Terveyspalvelujen kustannukset ja rahoitus Suomessa 1960–91. Kansaneläkelaitoksen julkaisuja T9:47. Helsinki 1993c.

Lääkelaitos (National Agency for Medicines and The Social Insurance Institution). Finnish statistics on medicines 1992. Helsinki 1993.

Max W, Rice DP, MacKenzie EJ. The lifetime cost of injury. Inquiry 27: 332–343 (Winter 1990).

Mishan EJ 1971. Evaluation of life and limb: a theoretical approach. Journal of Political Economy 1971;79:687–705.

Nordic Council on Medicines 1982–1993. Nordic Statistics on Medicines 1978–1992. Uppsala, Sweden.

Pekurinen M. Economic aspects of smoking: Is there a case for government intervention in Finland? National Agency for Welfare and Health. Research Reports 16/1991. Helsinki 1991.

Pyörälä K, Palomäki P, Miettinen H, Mustaniemi H, Salomaa V, Valkonen T 1994. Decline in coronary heart disease mortality in Finland: effect on age and gender distribution of the disease. American Journal of Geriatric Cardiology. May/June 1994.

Sairaalaliitto. Finnish hospital statistics 1972–1990. Helsinki 1991.

Suomen Kaupunkiliitto, Suomen Kunnallisliitto, Finlands Svenska Kommunförbund. Statistics on health centres' economy 1982 and 1991. Helsinki 1992.

Suomen Kuntaliitto. Finnish hospital statistics 1992. Helsinki 1993.

STAKES. Unpublished hospital discharge register data provided by National Agency for Welfare and Health, 1993.

Tilastokeskus (Statistics Finland). Income Distribution Statistics 1977–1990. Helsinki 1993a.

Tilastokeskus (Statistics Finland). Index of Wage and Salary Earnings. Helsinki 1993b.

Tilastokeskus (Statistics Finland). National Accounts 1960–1992. Helsinki 1993c.

Tilastokeskus (Statistics Finland). Labour Force Statistics 1991. SVT Labour Markets 1992:22. Helsinki.

Tilastokeskus (Statistics Finland). Consumer price index, February 1993. Helsinki 1993d.

Tilastokeskus (Statistics Finland). Causes of death 1972–1992. Helsinki 1993e.

Tilastokeskus (Statistics Finland). Life tables 1971–90. Helsinki 1993f.

V

Other Experiences and Discussion

21. EXPERIENCE WITH MAJOR SUBPROGRAMMES AND EXAMPLES OF INNOVATIVE INTERVENTIONS

Pekka Puska

This chapter describes and discusses a number of major components and sub-programmes of the North Karelia Project. All have been carried out within the theoretical and practical framework described earlier.

What follows is by no means an exhaustive description of the intervention activities in the North Karelia Project, but it does highlight a variety of activities and innovative programmes. The youth programmes are described and discussed separately.

1. INVOLVEMENT OF HEALTH SERVICES

A major intervention aim was the creation of a service structure to support the community's progress towards the objectives. The main principle throughout has been to exploit the existing service structures, with health services obviously assuming a key role.

With the project's needs in mind, useful existing activities in the health services have been strengthened and new elements created when necessary. The project has prepared several activity models, which have been implemented through official instructions, recommendations, circulars, training meetings, materials, and personal contacts.

The project has developed practical activities on the basis of the set objectives on one hand, and on understanding of the local situation on the other. The functioning of the existing services has been analyzed, while pilot health centres have also been used to develop appropriate and feasible models for work.

Primary health services have played a key role. These are the simple activities that are close to everyday life and in frequent contact with people. In the Finnish health structure the health centres provide these services.

The project has involved itself extensively in the work of the health centre doctors and public health nurses, each of whom was asked to help modify the risk factors of all patients and clients. Their activities have included inquirying about and recording the smoking history, advice to stop smoking, inquiry and advice on dietary habits, serum cholesterol and blood pressure measurements and advice to heart disease patients.

Since no extra manpower was obtained for the programme, the new tasks had to be integrated into the normal everyday schedule. Work often had to be re-organized to permit certain nurses or doctors to undertake more of some practical programme tasks. As more resources gradually became available in North Karelia (and throughout Finland), it became progressively easier to realize the new activities..

In the 70s the public health nurses' burden of work increased more than that of the doctors, though the registration of hypertensives generated considerable extra work for them, too, during the initial years. The public health nurses performed more general health education in the field and also undertook the main administrative work for the programme tasks (special offices, screenings, registers, etc). The doctors acted as medical advisors and support personnel.

During the early years of the project the main emphasis was on integrating the basic project needs into the existing service structure. After that it became both possible and necessary to introduce more specialized services to support the basic activities. These were prepared and tested by the project and implemented gradually through the channels mentioned above. For the anti-smoking programme, special smoking cessation services were introduced, while for serum cholesterol reduction, nutrition groups and counselling programmes were developed. Specialized services for hypertension control were also set up.

Usually, a simple inbuilt evaluation was outlined as the activities were specified. To instruct, ensure and check activities at the local level, staff from the Provincial Health Department and the project have frequently visited the local health centres and met the personnel.

Health services were heavily involved in project activities in the early years. This is described and discussed in greater detail in the original project report (Puska et al. 1981). The biggest work load was created by the hypertension programme, described in many publications (e.g. Nissinen et al. 1981, 1986).

During subsequent years many of the activities were integrated and sustained fairly well. Continuous training and other measures have naturally helped in this. The monitoring data, for instance, show that blood pressure measurements in North Karelia remain exceptionally frequent.

At the same time new activities have been introduced and supported by the health services. This particularly refers to the intensified cholesterol lowering activity which began in the late 80s and involved a great increase in serum cholesterol measurements and counselling by health services.

2. HYPERTENSION CONTROL PROGRAMME

Reduction of the province's generally high blood pressure levels was one of the three intermediate objectives of the North Karelia Project. During the planning it was obvious that a large proportion of people had hypertension and that most were either not even aware of it or not being treated.

Thus in the first phase, and in order to achieve fairly rapid results, much effort was devoted to setting up a systematic programme for detection, treatment and follow-up. A project working group formulated the content of this sub-programme, based on the relevant WHO recommendations.

As part of this sub-programme it was recommended that blood pressure measurements be taken at most contacts with the primary health service and also in connection with special blood pressure measurement activity. Most of the measurements were done by public health nurses, and the project prepared guidelines for the measurement techniques and reference values.

Following the agreed criteria, all people with repeated elevated values were registered in the special hypertension register of the health centre (copy sent to the project's computerized province-wide register). The patients received a personal hypertension follow-up card from the project. Thus repeated blood pressure measurement values were registered (monitored) both in the patient's own card and in their personal record held at the hypertension clinic.

The hypertension clinics at the health centres were mainly operated by a specially-trained public health nurse. In addition to blood pressure values and drug compliance, the nurse also focused on health behaviour and other risk factors relating to blood pressure. The doctors acted as clinical experts within this framework, drawing the initial diagnostic conclusions and initiating and monitoring the antihypertensive drugs etc.

Authority statements, training, instruction materials, patient materials etc. were used to establish and implement this activity. The public health nurses in charge of the hypertension clinics attended very frequent training sessions, during which feed-back was given and discussed.

During the initial five year period of the project nearly 20.000 hypertensives were registered in North Karelia, and this was a major component of the early phase of the project as far as the health centres were concerned. But the effort was justified - the evaluation (partly presented earlier) demonstrated both the feasibility and beneficial results of the hypertension activities.

After that period the centralized provincial register of the project ceased, but monitoring etc. continued at the health centres. Subsequent evaluation showed that these activities became well integrated into the normal work of the health centres. The frequency of blood pressure measurements and coverage of treatment have remained surprisingly high.

At the end of the 70s more attention began to be drawn to the non-pharmacological control of high blood pressure. A special salt project was initiated using the established channels and methods of the project, including collaboration with the food industry. The results of the salt project demonstrated the feasibility and some initial progress, although changes in the salt consumption at the population level were slow.

During subsequent years the project helped maintain the blood pressure control activity at the health centres. At the same time there was increasing focus on the nonpharmacological measures - particularly dietary changes. In addition to salt, weight reduction and fat modification were emphasized. There was a series of special dietary trials on the potential for dietary control of blood pressure, and particularly on the likely role of fat (Puska et al. 1983).

Overall, the initial blood pressure programme was a major practical activity at the health centres. While it generated plenty of work it

also helped to establish and guide the overall project-related work at the health centres. Once established, other activities (e.g. cholesterol control) could start to be emphasized, too. This allowed the strategy for reducing the blood pressure level to start placing more stress on general dietary changes, thereby creating a link with the other project activities to influence the dietary habits of the population.

3. PERSONNEL TRAINING ACTIVITIES

Another important component of the project has been training of the various personnel groups that have implemented the planned activities in the local settings. Training has thus been based on the defined tasks and activities, and has usually consisted of general information about the health problems, principles for tackling them, performance of the new tasks, measurement techniques, internal monitoring, and practical aspects of the cooperation necessary.

Since the health centre personnel (doctors, public health nurses and other nurses) have occupied such key positions, much of the training has been directed at them. Training has also been given to other health personnel (hospital doctors, teachers, home economics teachers and social workers), and to leaders and counsellors of voluntary organizations and journalists.

An official community leader network was established at the start of the project. This group received project bulletins and other educational materials. Later on, much larger numbers of local "lay leaders" were trained systematically in order to reinforce change in the community (see section 5).

Because the basic education of the personnel could not be modified and a great number of workers in the area were involved, the principal training method has been 1–2 day seminars. These have usually been organized jointly by the health department of the province and the project. Voluntary organizations or other agencies have often been involved. Individuals attending the training have been asked to pass on their new knowledge to the other workers at their own health centre. Regular health centre training activities have been encouraged.

Many of the regular training seminars have dealt with specific subprogrammes or activities. Thus the nurses (often with physicians) assigned to hypertension, antismoking, screening or rehabilitation subprogrammes, or to maintaining the AMI and stroke register, have attended regular training seminars. Other seminars have concentrated on more general programme tasks, e.g. general health education.

The participants have usually represented a spectrum of professions related to the activities concerned, though sometimes trainings involve only a single profession. For example, the project initially organized large biannual and later annual two-day seminars for North Karelian doctors. In addition, project representatives have frequently lectured at professional meetings in the area.

Training has always been supported by the distribution of materials, of which the project has developed a great variety. Several guidebooks and other programme materials have been prepared.

The content of training seminars has largely been determined by the project team, the representatives of the provincial health administration, and specialists at the central hospital. Regional and national experts have been used when necessary. Health centre workers or others engaged in practical tasks have always contributed as representitives of the field situation and to provide feed-back.

Over its 20 years, the project has initiated or been otherwise involved in hundreds of training seminars. Although the nature of the seminars has changed, the focus has always been the discussion of practical tasks (derived from the objectives), action needed, and progress and feedback.

4. THE PRINT MEDIA

The project has produced a large range of printed materials since 1972. All have been prepared to support particular objectives and community activities/campaigns. Printed materials have always been used to supplement more comprehensive activities which have usually also been supported by health services and/or voluntary organizations, other types of media etc.

The following list gives some idea of the extent to which the print media were exploited during the five first years of the Project (1972–77)

– local newspaper articles: (877.000 column mm)	1509	
– project's information bulletin:	3.000	copies
– posters	22.000	copies
– "wall papers"	22.600	copies
– anti-smoking signs	80.000	copies
– anti-smoking stickers	74.000	copies
– health education leaflets (series of five)	278.000	copies
– Fathers' Day cards	97.000	copies

The use of these materials and their coverage are described in more detail in other publications (Puska et al. 1981, Kottke et al. 1984).

After the initial period the press remained interested in the project; newspapers frequently reported on project activities and new findings, and various types of collaboration took place.

A range of printed materials also continued to be produced, particularly posters, leaflets and anti-smoking signs supporting various behavioural modifications and campaigns. Many materials were produced in collaboration with other parties and often sponsored by them. Practically all materials were printed in North Karelia, so the project came to be a good customer of several of the printing companies.

The gradual spead of many of the materials into national use became just one way in which the project work assumed a nationwide dimension. Some materials were distributed in connection with special campaigns, and many (leaflets, self help guide books) were purchased by health centres, other organizations and individuals across Finland.

5. THE LAY LEADER PROGRAMME

After a few years of implementation, the project team discussed further actions needed to influence the lifestyles in North Karelia on the grassroots level. The relevant theories were considered and attention focused on the principles of the two-step flow of information and of opin-

ion leaders. In every population and community, informal opinion leaders affect attitudes and behaviours in their sphere of influence.

The project team and local representatives considered how this theory could best be used to benefit the programme. The lay leader programme was formulated and launched on the basis of their conclusions.

In every municipality of the province local community leaders and other informants were interviewed to discover the opinion leaders in the local villages. These people were approached, told about the project and invited to be project "assistants". They received initial instructions over a week-end seminar, and then regular contacts and follow-up.

The central idea was to get the lay leaders (active people and members of many organizations) to pay systematic attention to health-related lifestyles (targets of the project) and the necessary environmental changes in their daily lives, and to try to promote the appropriate changes; for example: discussing smoking and diet with people they meet, promoting smoke-free meetings and facilities, urging local grocery storekeepers to improve the availability of cholesterol lowering foods etc.

By 1979 a training meeting for lay workers had taken place in every municipality of North Karelia, and by the end of 1982 almost all had had one or two follow-up training sessions. By this time over 800 people had been recruited as lay workers and participated in the initial training.

This programme worked well in practice and obviously made a useful contribution to the success of the project. The main evaluation results and further details of the implementation are published elsewhere (Puska et al. 1986).

6. THE WORKSITE PROGRAMMES

Over the years the project became progressively involved with worksite health promotion activities. Various worksites have contacted the project, and numerous activities planned and implemented. These have usually involved simple risk factor measurements and counselling, general information on health promotion, collaborative action (e.g. joint sports activities, weight reduction groups etc.), changes in worksite canteens (e.g. better availability of vegetables, low fat products etc.), and smoking policies at the worksite.

In the 80s, a special worksite project was carried out to gather experiences and learn about the effects of this type of approach. For a TV programme on the project (see section 7) eight middle-sized worksites were chosen in different parts of North Karelia. One smoking worker from each worksite was invited into the studio group of the programme.

During the TV series these people tried to stop smoking, improve their diet, increase physical activity and take up other health promoting activities. Each acted as the role model for his/her workmates at the worksite, where various supportive activities were also arranged. These included risk factor measurements, counselling, modifications in the food served at the worksite canteen etc.

For the evaluation, eight matched worksites were selected. Risk factors and health behaviours were thus measured at the outset and at the end of this one-year experimental period in all sixteen worksites. The evaluation demonstrated clear benefits, especially on smoking (Puska et al. 1988).

Worksite intervention activities have since been implemented at a variety of worksites, and been used to demonstrate dissemination and community organization.

The experiences generated have often been publicized by the project in the media. Worksite health programmes at many strategic worksites (e.g. bakeries, newspapers) have also exerted favourable influence on the respective organizations. For instance, the largest bakery in North Karelia made major production changes after joining this programme.

7. THE TV PROGRAMMES

Since 1978, several major nationwide TV series have been broadcast as collaborative efforts between the North Karelia Project and Finnish TV2. In the planning stages, careful attention was paid to to the relevant theories on communication and behaviour change, as discussed earlier in this book.

The TV series broadcast so far:

Topic	year	number of programmes (appr. 30–45 minutes each)
Stop smoking	1978	7
- " - (repeat)	1979	8
Keys to Health	1980	10
- " -	1982	15
- " -	1984–85	15
Stop smoking	1986	8
-"-	1989	9

The programmes have all used the same format: a group of voluntary high risk people in the studio along with a couple of project experts. The "role models" try to make healthy changes in their lifestyles, with the help of the experts. These experts discuss with the studio group the benefits and necessary skills for the lifestyle changes needed, while also giving advice to the viewers.

The TV programmes were planned by the project but implemented by TV2, which is a public channel and one of the three national TV channels. The programme costs were met by TV2 out of their normal programme funding resources.

The national TV programmes were accompanied by printed materials and various community organization efforts, especially in North Karelia, where advantage was taken of the well-established project networks.

This venture proceeded well, and the viewing rates were high – even among the lower socioeconomic and high risk population groups. The absolute effects have been substantial and thus the cost-benefit ratios have been high; the secondary impacts have also been obvious (Puska et al. 1987, Korhonen et al. 1992). The project's TV programmes have undoubtedly acted as a powerful intervention tool, and been a major avenue for nationwide application of the project work.

8. QUIT AND WIN CONTESTS

During the last two STOP SMOKING TV series (in 1986 and 89), major 'Quit & Win' contests were organized. These are designed to increase community participation and incentives for positive action.

In the first contest over 16.000 Finnish smokers participated. The six month abstinence rate of the participants was about 20 %. The second contest was organized jointly between Finland and Estonia.

The general experience has been quite favourable (Korhonen et al. 1992), with the effects being consistently greater in North Karelia than in the rest of Finland.

Recently a WHO/CINDI Quit and Win campaign was arranged in spring 1994. It was based on the above experiences and carried out in 13 countries, Finland included. Again special efforts took place in North Karelia.

9. COLLABORATION WITH THE MARTTA (HOUSEWIVES') ORGANIZATION (AS AN EXAMPLE OF VOLUNTARY ORGANIZATIONS)

There has been close collaboration with the MARTTA housewives' organization, especially for influencing dietary habits in North Karelia. This organization is very influential in rural and semi-rural areas, especially when it comes to the adoption of novel cooking practices.

In addition to the broad on-going collaboration, several specific co-operative programmes have been carried out: "the Parties for Long Life" in the 70s, "the Happy Hearts' Evening" in the 80s, and a weight reduction campaign in the early 1990s. All these programmes have occupied thousands of housewives and their families.

The basic principle of the collaboration has been as follows. The project has first identified the general health needs, and a fairly practical activity then jointly planned; this has been implemented by the MARTTA organization and supported by the project. Printed support materials have usually been prepared. The formative evaluation has been arranged jointly by the MARTTA organization and the project.

10. CHOLESTEROL LOWERING COMPETITIONS BETWEEN VILLAGES – AN EXAMPLE OF INNOVATIVE CAMPAIGNING

When the intensified cholesterol lowering activities were being planned in the late 80s, cholesterol levels tended to be highest in the more re-

mote rural areas, where more traditional diets high in dairy fat prevailed. Based on this phenomenon and the notion of genuine community action, the project announced a competition involving dietary changes for cholesterol lowering between villages willing to participate.

The project team first wanted to stage a demonstration competition between a couple of villages, but it turned out that 40 of them wanted to join in. The first competition was between seven villages. The project undertook the initial cholesterol measurements in the adult villagers, who thereafter organized various activities among themselves to promote cholesterol-lowering dietary changes. After a little over two months the cholesterol levels were remeasured. The winning village had an average cholesterol reduction of 11 %, and the mean reduction of all the participating villages was about 5 %.

So that more villages could join in, the competition was repeated half a year later, again with a good outcome. The experiences have been exploited in the media to demonstrate the feasibility of cholesterol reduction.

11. THE BERRY PROJECT

Over the years many individuals and community leaders have voiced economic concerns about staging a project of this type in an area which was initially substantially devoted to dairy farming. With people sharply reducing their consumption of butter and fatty dairy products, economic problems have emerged for dairy farmers and the dairy industry. The other side of the coin is that people complying with the health message have consumed progressively more fruit and vegetables, much of which has been imported produce.

During their discussions, the community and project representatives considered the feasibility of growing tasty, nutritious berries in the North Karelian climate. The focus of attention were black and red currants and strawberries, in addition to the wild berries growing in the large forest areas.

In 1985 a major collaborative project was conceived with inputs from berry farmers, the berry industry, various commercial sectors and the health authorities; it was financed by the Ministry of Agriculture and

the Ministry of Commerce. Over a five-year period innovative activities took place to promote the consumption of local berries and berry projects. Information and education was involved, but also sales campaigns, new product development and various supportive activities.

Local berry consumption has subsequently gradually risen; in several parts of the province berry growing has increased substantially, and many farmers have switched from dairy to berry production.

A report on the original berry project describing the approach and outcomes has been published (Kuusipalo et al. 1986). Based on the favourable experiences the local berry farmers again contacted the project, and a new berry project has recently been launched to lend further support to this beneficial change process.

12. COLLABORATION WITH FOOD MANUFACTURERS AND SUPERMARKETS

Since its inception, lively collaboration has taken place between the project and sections of the food industry. In the 70s this mainly concerned the promotion of low fat dairy products along with the dairies, the promotion of low fat sausages with the local sausage factory and, in the late 70s, the reduction of salt in a number of food items. Many collaborative campaigns have also taken place in and with the supermarkets and their branch stores.

In the late 1980s, intensive activities began to promote further dietary changes aimed at lowering cholesterol levels, which were still high. There was close collaboration between the project and manufacturers of vegetable oil-containing products. One major break-through was the successful development of a domestic rape seed oil.

In partnership with the industry, the use of vegetable oil (particularly rape seed oil) in cooking was promoted. There was also intensive activity devoted to the development and marketing of various fatty spreads with high contents of vegetable oil and often reduced amounts of total fat. Collaboration with the biggest bakery in North Karelia, for example, resulted in an almost complete change from butter use to vegetable oil margarine.

13. ANTI-SMOKING POLICIES/LEGISLATION

In the early years of the North Karelia Project, one of the anti-smoking goals was to increase the number and accessibility of non-smoking areas. This was achieved by various types of message, and by distributing large numbers of "no smoking" signs and stickers. A very popular sign was "NO SMOKING HERE – we participate in the North Karelia Project". The project also discouraged the display of tobacco advertisements and other promotional materials.

In 1977 the Finnish National Parliament finally passed an anti-smoking law that had been under discussion for several years. Project representatives had actively participated in this discussion, with the director of the project being invited to the parliamentary committee hearings.

The new law eliminated all tobacco advertising in Finland from 1978 on and prohibited smoking in most public places indoors. It prohibited the sale of tobacco to youngsters obviously younger than 16 years, and required health warnings on cigarette packages etc. It also stipulated that 0.5 % of tobacco taxes be devoted to anti-smoking programmes and research (the project was subsequently granted some of this money).

The late 80s and early 90s saw intensifying discussions to improve the legislation, and project representatives were once again actively involved. Finally, in June 1994, parliament passed major amendments prohibiting worksite smoking except in individual offices and special smoking rooms, as well as the sale of tobacco to those below 18 years of age etc.

Over the years the project has also carried out intensive campaigns to promote smoke-free worksites and maximize indoor smoke-free areas. This was achieved through consultations, trainings, promotional campaigns (e.g. via local radio, awarding prizes etc.) and by distributing signs. This time the main sign read "SMOKE-FREE AREA – smoke-free North Karelia". The governor of North Karelia, along with various decision makers and opinion leaders, formerly endorsed this initiative, which was directed at worksites and municipalities.

14. LEGISLATIVE AND POLICY CONTRIBUTIONS

During the project several of its leading members have been active in various health and health research policy functions.

The project contributed to the passage of the anti-smoking legislation in 1977, as described earlier, and was also involved in the development and availability of commercial mixtures of butter and vegetable oil. In addition, project members occasionlly participated in certain health policy planning activities (concerning health education, hypertension care etc.).

On the local level in North Karelia, the project was in frequent contact with municipal and local health centre decision makers. These sometimes took place formally, but often as closer personal contacts – as did much of the community organization work. In the 70s formal surveys also took place among local decision makers and health personnel (Puska et al. 1981).

In the 80s the project remained active in national health policy. Moving the project coordination centre to the National Public Health Institute was a great help, since the institute is a major national expert agency under the Ministry of Health. Another obviously important factor was that the project director was elected to represent North Karelia in the national Parliament for the period 1987–91.

In the late 80s and early 90s the project was especially active in facilitating the production and marketing of healthier foodstuffs. Another major goal was to reinforce the anti-smoking legislation, which finally succeeded in 1994.

REFERENCES

Korhonen HJ, Niemensivu H, Piha T et al. National TV smoking cessation programme and contest in Finland. Prev Med 1992;21:74–87.

Kottke TE, Nissinen A, Puska P, Salonen J, Tuomilehto J: Message dissemination for a community-based cardiovascular disease prevention program (the North Karelia Project). Scan J Prim Health Care 1984;2:99–104.

Kuusipalo J, Mikkola M, Moisio S, Puska P. The East Finland Berry and Vegetable Project: A health-related structural intervention programme. Health Promotion 1986;1:385–391.

Nissinen A, Tuomilehto J, Elo J, Salonen JT, Puska P: Implementation of a hypertension control program in the county of North Karelia, Finland. Public Health Reports 1981;96:503–514.

Nissinen A, Tuomilehto J, Kottke T, Puska P: Cost-effectiveness of the North Karelia hypertension program 1972–1977. Med Care 1986;24:767–780.

Puska P, Neittaanmäki L, Tuomilehto J: Survey of local health personnel and decision makers concerning the North Karelia Project. A community program for control of cardiovascular diseseases. Prev Med 1981;10:564–576.

Puska P, Iacono JM, Nissinen A, Korhonen HJ, Vartiainen E, Pietinen P, Dougherty R, Leino U, Mutanen M, Moisio S, Huttunen J: Controlled, randomized trial of the effect of dietary fat on blood pressure. Lancet 1983;1:1–5.

Puska P, Koskela K, McAlister A, Mäyränen H, Smolander A, Moisio S, Viri L, Korpelainen V, Rogers EM: Use of lay opinion leaders to promote diffusion of health inoovations in a community programme: lessons learned from the North Karelia Project. WHO Bull 1986;64:437–446.

Puska P, McAlister A, Niemensivu H, Piha T, Wiio J, Koskela K. A television format for national health promotion: Finland's "Keys to Health". Public Health Rep 1987;102:263–269.

Puska P, Niemensivu H, Puhakka P, Alhainen L, Koskela K, Moisio S, Viri L: Results of a one-year worksite and mass media based intervention on health behaviour and chronic disease risk factors. Scand J Soc Med 1988;16:241–250.

22. THE NORTH KARELIA YOUTH PROGRAMMES

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1. INTRODUCTION

Cardiovascular and other chronic diseases comprise the major public health problem in most of the industrialized world, and in the last few years it has become increasingly apparent that activities to prevent them should start in childhood (Wynder et al. 1989, Report on Pediatric Research, 1989). There are strong epidemiological justifications for aiming health-promotion at young people. The first argument for starting primary prevention early in life is the early onset of many chronic diseases; the second is that major risk factors and their related behavioural patterns begin in childhood and youth. The serum cholesterol level of Finnish children is known to be extremely high in international comparisons (Knuiman et al. 1980, Vartiainen et al. 1982, Viikari et al. 1985).

Four different studies have been carried out in association with the North Karelia Project to assess the extent to which cardiovascular risk factors can be prevented in childhood and adolescence. The first two studies were family-based, while the other two were more community and school-based programmes. All were designed and conducted in pursuit of the overall aims of the North Karelia Project.

2. DIETARY STUDIES WITH FAMILIES

The main purpose of the family studies was to assess whether the serum cholesterol and blood pressure of children can be influenced by dietary modification. The first dietary intervention involved 30 free-living families in rural North Karelia and consisted of a two-week baseline period, a six-week intervention period, and a six-week switch-back period. Dur-

ing the intervention the parents were instructed to eat a low-fat diet with high ratios of polyunsaturated to saturated (P/S) fats, and to keep food records every second day. There were 16 children aged 13 to 15 years (8 boys and 8 girls) in 12 families. The parents were told that the intervention diet would also be healthy for their children, although the children's diet was not monitored. Among the parents, the proportion of energy from fat decreased from 39% at baseline to 24% during the intervention period and returned to 36% during the switch-back period. The respective P/S ratios were 0.13, 1.17, and 0.16. The serum total cholesterol values of the parents decreased from 6.4 mmol/l to 4.9 mmol/l (23%) and those of the children from 5.6 mmol/l to 4.9 mmol/l (13%). In both parents and children, but more in the parents, the values rose again during switch-back.

Children participated more actively in the second study (Vartiainen et al. 1986). Their diets were monitored via dietary records kept on three days of each period. The families involved had 36 children aged 8–18 years, and lived in two semi-rural communities in North Karelia. After a baseline period of two weeks on a conventional diet, the propor-

	BASELINE (N=36)	INTERVENTION (N=36)	SWITCH-BACK (N=36)
PROTEIN (G)	82 ± 25	78 ± 22	68 ± 21
(%)	14 ± 2	15 ± 2	13 ± 2
CARBOHYDRATES (G)	310 ± 84	319 ± 101	285 ± 77
(%)	51 ± 5	60 ± 4	53 ± 5
FAT (G)	94 ± 32	55 ± 20	91 ± 25
(%)	35 ± 4	24 ± 4	34 ± 5
SATURATED FATS (G)	52 ± 18	23 ± 8	44 ± 13
(%)	20 ± 3	10 ± 2	19 ± 4
MONOUNSATURATED FATS (G)	30 ± 11	17 ± 7	25 ± 9
(%)	11 ± 2	7 ± 1	11 ± 2
POLYUNSATURATED FATS (G)	9 ± 4	13 ± 6	9 ± 4
(%)	3 ± 1	6 ± 2	4 ± 1
CHOLESTEROL (MG)	408 ± 142	274 ± 128	359 ± 151
P/S RATIO	0.18 ± 0.29	0.61 ± 0.24	0.20 ± 0.10
ENERGY (KCAL)	2373 ± 644	2033 ± 616	2099 ± 563

Table 22.1. Means and standard deviations of calculated daily intake of nutrients in grams and percentages of energy intake

tion of energy derived from fat declined during the 12-week intervention period from the baseline level of 35% to 24%, while the ratio of polyunsaturated/saturated fats increased from 0.18 to 0.61 (Table 21.1). The children were then free to revert to their normal diet during a five-week switch-back period. Mean serum total cholesterol decreased by 15% during the intervention and then rose almost back to the initial level during the switch-back period (Table 21.2).

Similar changes were observed in high-density lipoprotein (HDL) cholesterol and also, to some extent, in apolipoproteins AI, AII and B. Blood pressure was not significantly affected, although systolic blood pressure tended to decrease during intervention but did not increase again during the switch-back period.

Thus the high serum cholesterol levels observed in many Finnish epidemiological studies seem to be caused mainly by the typical Finnish diet and are amenable to dietary modification. The next issue concerns the extent to which the diet can be improved in an entire population. This continues to be a principal aim of the first and second North Karelia Youth Projects.

	BASELINE (N=31)	INTERVENTION (N=31)	SWITCH-BACK (N=31)
CHOLESTEROL (MMOL/L)	4.94 ± 1.01	4.18 ± 0.65[b]	4.65 ± 0.76[b]
HDL CHOLESTEROL (MMOL/L)	1.45 ± 0.30	1.20 ± 0.22[b]	1.41 ± 0.26[b]
TRIGLYCERIDES (MMOL/L)	0.86 ± 0.37	1.00 ± 0.43	0.91 ± 0.35
APO AI (MG/DL)	143 ± 23	131 ± 16[b]	142 ± 21[b]
APO AII (MG/DL)	37.3 ± 5.4	35.9 ± 4.4[a]	37.3 ± 5.0[a]
APO B (MG/DL)	77.5 ± 13.4	72.8 ± 12.8[a]	79.2 ± 15.4[b]
SYSTOLIC BLOOD PRESSURE	118 ± 13	114 ± 14[b]	113 ± 12
DIASTOLIC BLOOD PRESSURE	72 ± 11	69 ± 10[b]	68 ± 11

[a] $p<0.05$; [b] $p<0.001$; one-tailed paired t-test

Table 22.2. Means and standard deviations of serum lipids and apolipoproteins and blood pressure at the end of the three periods

3. THE FIRST NORTH KARELIA YOUTH PROJECT (1978–1980)

3.1. Introduction

The aim of the first North Karelia Youth Project, implemented between 1978 and 1980, was to assess whether a community and school-based educational intervention can be feasible and effective in preventing smoking and for influencing habits which affect serum cholesterol and blood pressure levels. The study protocol was designed using the framework of the World Health Organization (WHO) protocol Atherosclerosis Precursors in Children (WHO 1978) and the international Know Your Body Program (Wynder et al. 1981). Following the initiation of similar planning in other European centers, the study also joined the WHO collaborative study Health Promotion in Youth. The principles and actual methods of the North Karelia Youth Project have been described in greater detail elsewhere (Puska et al. 1982). This report concerns the effects of the intervention on smoking, diet, serum cholesterol, and blood pressure levels.

A two-year programme was carried out among school children in North Karelia who were in the 7th grade (13 years old) during the autumn of 1978.

The full programme was implemented by project team members in the two direct intervention schools. A further aim of the project was to assess whether an intervention in all schools in the province, based on local activities following administrative and training measures, would be feasible and have similar effects.

Thus the same measures were recommended to other schools in North Karelia and the training and materials made available.

The purpose of the smoking prevention programme was to enhance the perceived social desirability of non-smoking and to teach children the skills of resisting social pressures associated with smoking. The programme used 14 and 15-year-old peer leaders of both sexes as the primary agents for delivering the non-smoking message in the classroom. These youngsters served as positive role models for those likely to start smoking. Ten sessions were held in the direct intervention schools, while five sessions covered the main elements of the programme in the province-wide intervention.

The goal of the dietary intervention was to lower serum cholesterol levels by reducing total fat consumption and increasing polyunsaturated fatty acid consumption, reducing dietary cholesterol, and increasing the fiber content of the diet. Blood pressure was to be influenced mainly by the reduction of sodium intake. Prevention of obesity was also an objective, although it was given less emphasis because obesity rates were not very high.

In Finland, all children are provided a free school lunch. In the two direct intervention schools, butter used on bread was replaced by soft margarine (with P/S ratio > 1), and whole milk (2.9 to 3.9% fat) by skim milk (fat <0.05%), buttermilk (fat <0.08%), or water. Vegetable oil was used for salad dressings and cooking. Low-fat meat products were offered when possible. The use of fish, poultry and a variety of vegetables and fresh salads was promoted. Egg yolks were avoided. Food manufacturers serving the schools were requested to reduce the salt content of their products, and the salt used in cooking was substituted by a special mineral salt which had approximately 30% of the sodium replaced by magnesium and potassium. These changes were also recommended for the other local schools and for meals at home.

In the direct intervention schools, a nutritionist visited the homes of the children in the upper 15th percentile of the cholesterol and blood pressure distributions. Healthy diet was also discussed during school lessons. Parent gatherings, leaflets, posters, written recommendations, a project magazine, and the general mass media were used to promote behaviour change. Screening results were explained to the children by a nurse, and a special health passport was used. A school nurse repeated the screening once or twice a year and gave advice and counselling to children using the health passport. Behaviour changes in different school classes were monitored by repeated small surveys and were displayed as charts and discussed at school.

3.2. Study Design and Measurements

The baseline survey in 1978 involved the two direct intervention schools (one urban, one rural), two matched schools representing the rest of the North Karelia (one urban, one rural), and two more matched schools (one urban, one rural) in a reference area in another province of eastern

Finland. Matching was based on the population and socioeconomic features of the municipalities. All the children in the 7th grade of these six schools and their parents were studied, and the composition of the school meals was also examined.

There was a follow-up survey immediately after the two-year programme in autumn 1980, with the same measurements as in the baseline survey. Three more follow-up surveys were done, mainly to assess smoking status: the first in spring 1981, the second in autumn 1982, and the third in 1986. There were 966 children in the 7th grade in 1978; 62 of them left school during the intervention period, leaving 904 children in the study. All of the children participated in the baseline survey, 85% in the first follow-up, 81% in the second, 84% in the third, and 75% in the last follow-up in 1986. Smoking was assessed by a questionnaire. Blood pressure was measured twice from the right arm with a 12 x 22 cm cuff. Serum cholesterol was measured by Liebermann-Burchard reaction in the first survey and enzymatically in the second.

3.3. Results

3.3.1. Smoking

The percentages of children who reported smoking at least once or twice a month in the different school groups are shown in Figure 22.1. In the baseline survey, before the programme began in the 7th grade, 4–9% of the schoolchildren were smokers by this criterion. The proportion who smoked rose in the reference schools by twice as much as in the intervention schools. Immediately after the programme, in the 9th grade, 20% of the children reported smoking in both types of intervention school, while in the reference schools the respective proportion was 30% ($p < 0.005$). In spring 1981, six months after the intervention programme had finished, the proportion of smokers had increased by 2–5% in all the school groups, but by more in the reference schools. The difference in the number of smokers between the control schools and both types of intervention school was again statistically significant.

The next follow-up was carried out two years after the programme ended (four years from the start). Now, the proportion of children reporting that they smoked was 27% in the direct intervention schools,

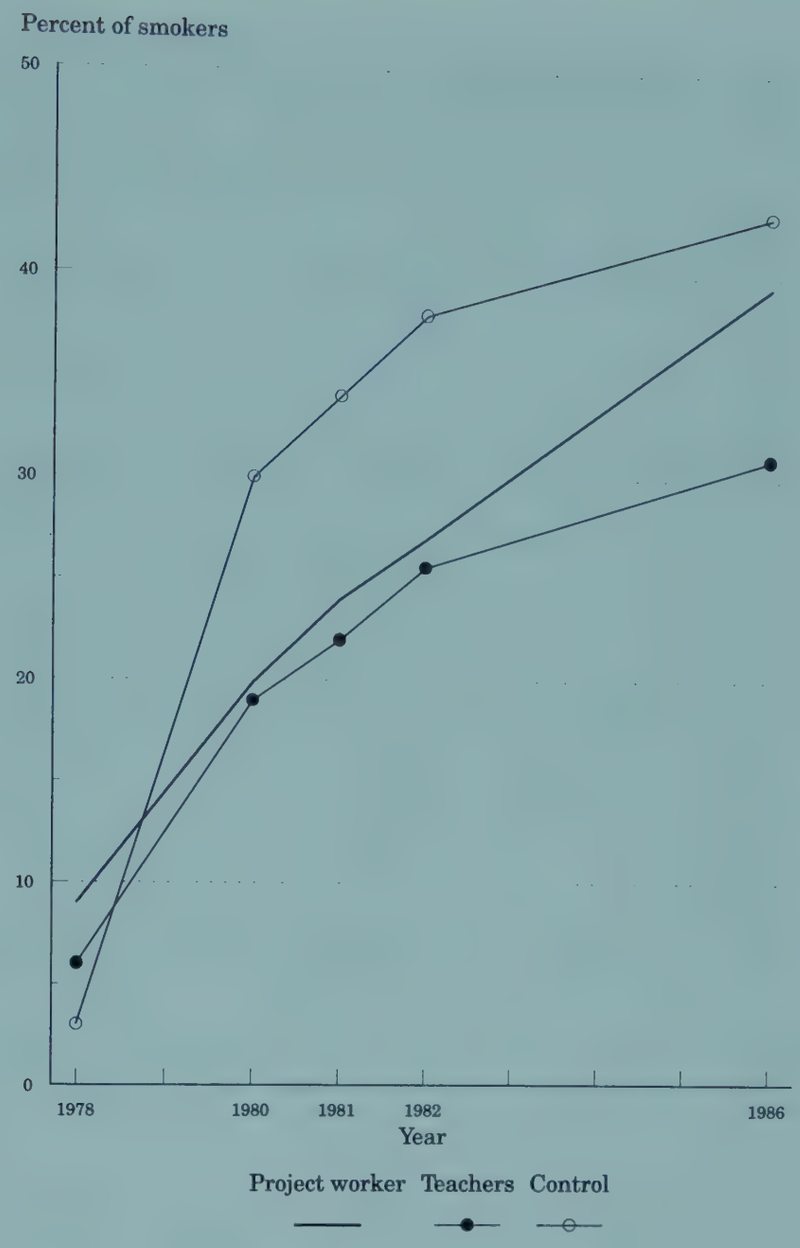

Figure 22.1. Effect on smoking

26% in the province-wide intervention schools, and 37% in the reference schools ($p < 0.05$ and $p < 0.001$). In the last, eight-year, follow-up there was still a difference between the teacher-led intervention schools and the reference group, but that between the direct intervention and reference schools was not statistically significant (Vartiainen et al. 1990).

3.3.2. Diet and Total Serum Cholesterol

The changes in the school diet are shown in Table 22.3. In all three school groups before the intervention, about 37% of the daily energy from school meals was derived from fat. This subsequently decreased by about 5% in all the school groups. The P/S ratio rose in the direct intervention school diet from 0.13 to 0.60. The main reason for this was that butter was replaced by soft margarine and fatty milk by skimmed milk,

	ENERGY (KCAL/MEAL)			PROPORTION OF TOTAL ENERGY (%)								
				PROTEINS			FATS			CARBOHYDRATES		
	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE
DIRECT INTERVENTION	503	463	−40	18.5	18.0	−0.5	36.5	32	−4.5	45	50	+5
COUNTY-WIDE INTERVENTION	548	523	−25	15.5	16.5	+1.0	36.5	31.5	−5	49	52	+3
REFERENCE SCHOOLS	514	549	+35	18.5	17.5	−1.0	38	33	−5	43.5	49.5	+6
				DIETARY CHOLESTEROL (MG/4.2 MJ)			IRON AND VITAMIN C (MG/100 KCAL)					
	P/S RATIO			(1000 KCAL)			IRON			VITAMIN C		
	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE
DIRECT INTERVENTION	0.13	0.6	+0.47	212	168	−44	8.5	11.0	+2.5	57	74	+17
COUNTY-WIDE INTERVENTION	0.14	0.17	+0.03	239	199	−40	10.2	8.5	−1.7	66	60	−5
REFERENCE SCHOOLS	0.14	0.15	+0.01	255	223	−32	10.4	11.2	+0.8	62	62	0

Table 22.3. Content of school meals in 1978 and in 1980, and the change per school group.

and vegetable oil was used for cooking and salads. In addition, the dietary cholesterol decreased more in the intervention school diets.

There was a clear decrease in the daily amount of fat obtained from milk and butter in the direct intervention schools (Table 22.4). Among boys the decrease was 17% (from 48 g to 40 g), and among girls 46% (from 35 g to 19 g). The main reason was the change in the type of milk the children usually drank at home and school. The proportion of children who had switched from full milk (4.9% fat) or from "normal" milk (3.9%) to low fat milk was 12% in boys and 20% in girls.

The average total serum cholesterol was 5.1 mmol/l at the outset. This declined by about 0.5 mmol/l among boys in all three groups of schools, but among girls the decrease was 0.43 mmol/l in the direct intervention schools, 0.35 mmol/l in the province-wide intervention schools, and 0.21 mmol/l in the reference area schools. The difference between the girls of the direct intervention and reference area schools was significant ($p<0.01$) (Table 22.5). Covariance analysis using the base-

	BOYS				GIRLS			
	DIRECT INTERVENTION	COUNTY-WIDE INTERVENTION	REFERENCE AREA	ANOVA[b]	DIRECT INTERVENTION	COUNTY-WIDE INTERVENTION	REFERENCE AREA	ANOVA[b]
MILK AT (G) 1978	48 ± 26	53 ± 29	54 ± 29	NS	35 ± 17	36 ± 19	40 ± 21	NS
MILK FAT (G) 1980	40 ± 32	52 ± 27	57 ± 27	p<0.001	19 ± 14	33 ± 19	35 ± 19	p<0.01
CHANGE 1978–80	−8 ± 35	0 ± 28	−3 ± 29	p<0.01	−16 ± 16	−2 ± 19	−5 ± 18	p<0.01
n	159	148	128		135	135	146	
		p < 0.001[c]				p < 0.01[c]		
			NS[c]				NS[c]	

[a] Means ± standard deviations (SD)
[b] ANOVA, analysis of variance
[c] Two-tailed t-test

Table 22.4. Daily milk fat consumption (g) in 1978 and in 1980 and the change in two years per school group and sex*

	BOYS				GIRLS			
	DIRECT INTERVENTION	COUNTY-WIDE INTERVENTION	REFERENCE AREA	ANOVA[b] ANCOVA	DIRECT INTERVENTION	COUNTY-WIDE INTERVENTION	REFERENCE AREA	ANOVA[b]
SERUM TOTAL CHOLESTEROL (MMOL/L) AT THE OUTSET	5.08 ± 0.89	5.21 ± 10.7	5.15 ± 0.82	NS	5.12 ± 0.93	5.11 ± 0.81	5.07 ± 0.77	NS
SERUM TOTAL CHOLESTEROL (MMOL/L) IN THE FOLLOW-UP	4.55 ± 0.94	4.71 ± 0.91	4.60 ± 0.77	NS	4.69 ± 0.93	4.76 ± 0.76	4.86 ± 0.79	NS
UNADJUSTED CHANGE (MMOL/L)	−0.53 ± 0.65	−0.50 ± 0.58	−0.54 ± 0.59	NS	−0.43 ± 0.69	−0.35 ± 0.67	−0.21 ± 0.51	p<0.05
ADJUSTED CHANGE (MMOL/L)[b]	−0.57 ± 0.65	−0.44 ± 0.58	−0.55 ± 0.55	NS	−0.44 ± 0.69	−0.34 ± 0.67	−0.22 ± 0.51	p<0.05
NUMBER OF CHILDREN	149	148	123		131	131 p < 0.01[c]	139	

[a] Means ± (SD)
[b] Analysis of covariance (ANCOVA), covariates: cholesterol at the outset, changes in sexual maturity, height and weight
[c] Two-tailed t-test

Table 22.5. Serum total cholesterol (mmol/l) at the outset and in the two-year follow-up, and the unadjusted and adjusted* changes in different school groups*

line serum cholesterol value as covariate did not change the observed difference between the school groups, and neither did adding differences in sexual maturity, height and weight into the covariance analyses. No effect on blood pressure was apparent.

4. THE SECOND NORTH KARELIA YOUTH PROJECT

Based on the experiences from the family dietary intervention studies and the first Youth Project, the second North Karelia Youth Project was launched in 1984 and 32 schools were enrolled. The study included about 8000 children in two age cohorts. Most of the intervention objectives remained the same as in the first youth project (Vartiainen et al. 1986).

Smoking and drinking are closely related habits in adolescence, and social influence and resistance-training programmes which seem to be effective in smoking prevention also appear to prevent heavy drinking.

Understanding of the sociopsychological processes involved in the onset of unhealthy behaviours has drawn attention to the utility of supplementing a preventive programme with efforts to improve relationships in the family and at school, and to reinforce social support and skills for coping with stress.

Against this background, the objectives of the programme are listed below:

Health behaviour:

* Prevent smoking.
* Prevent alcohol use and abuse.
* Improve nutrition:
  a. Decrease total fat intake.
  b. Increase the use of polyunsaturated fats and the ratio of polyunsaturated/saturated fats (P/S ratio).
  c. Decrease salt intake.
  d. Decrease sugar intake.
* Promote physically active life-styles.

Biological risk factors:

* Decrease serum cholesterol.
* Decrease blood pressure.

General sociopsychological factors:

* Promote positive social relations with peer group, adults at school and parents.
* Improve problem solving, coping skills, and social relationships.

4.1. Smoking and Alcohol Use

The intervention programme included peer leadership and training for social pressure resistance. At the start of each school year each class was asked to form small groups and each group to vote a leader. A short, two-hour group leader training by project staff was organized in the direct programme group. Group leaders assisted teachers in conducting role plays, encouraged their classmates to participate in project activities, and also served as role models.

Students were instructed about the nature of peer pressure and were taught how to resist pressures to smoke and abuse alcohol. Training included descriptions of peer pressures and demonstrations of resistance techniques on videotapes, accompanied by classroom practice of these techniques. There was also information about parental and other adult influences, correction of normative expectations, and activities focused on decision-making about tobacco and alcohol use, and on developing stress-coping skills and identifying resources for help. The programme comprised seven sessions in the 7th grade, five in the 8th grade, and three sessions in the 9th grade.

4.2. Nutrition Education

During the seventh grade all students participated in home economics classes. One lesson concerned diet, serum cholesterol and coronary heart disease. All the meals prepared in the home economics class contained less than 30% fat, and the P/S ratio exceeded 0.5. Teachers received special training to facilitate these changes. In the 9th grade one session focused on understanding food choices, and on eating behaviours and consequences. Students filled in a behaviour food record, and during the follow-up session individual dietary habits and the appropriate healthy changes were discussed.

4.3. School Lunches

Modifications in the school lunch were intended to reduce serum cholesterol and lower blood pressure. In Finnish schools a daily lunch is provided free to pupils. Formal support for the changes was obtained

from the national, provincial, and local administrations. Practical aspects were the subject of repeated discussions between the project nutritionist and the kitchen personnel. Training was provided and written explanations provided. The following recommendations were given to the school lunch services:

Use soft margarine on bread.
* Use skim milk.
* Use vegetable oil in cooking and salads.
* Use low-fat meat, fish, and poultry.
* Decrease the use of salt.

4.4. Health Screening

A health screening is normally conducted for all 8th grade students within the school's health care programme. In the project, special training was given in a one-day seminar, during which the health education component of the screening was discussed. Children's blood pressure was measured. Students found smoking in school were sent to the school nurse for a session at which the health hazards of smoking were briefly discussed, but most attention was focused on the pupil's life situation. The main aim of this has been to provide social support for stopping smoking and for coping with pressures or stress that may induce it.

4.5. Mass Media

A TV series of 15 programmes called "Keys to Health" was broadcast during the 1984-85 school year. Eight volunteer parents of children in the seventh grade at the direct programme schools participated in the studio group. A health education programme was carried out simultaneously at the work sites of these parents. Local and district newspapers were involved in the project, which provided them with a series of articles. A WHO meeting on prevention of non-communicable disease risk factors in children was held at the start of the intervention period and used to generate wide publicity for the programme in the newspapers. Feedback on the outcomes of the surveys was made available to the media.

4.6. Evaluation Design

The aim of the evaluation is to assess the feasibility and effects of the intervention programme. The study design is shown in Figure 22.2. Three groups of schools were selected. In the first, direct intervention was carried out by project workers, teachers and trained peer leaders. In the second group the intervention was done mainly by the teachers, with training and assistance from the project's health educators. Teachers were provided written and audiovisual materials. The third, control group consisted of eight schools where the normal health education was given.

The programme was applied to two age cohorts from 7th to 9th grades. In 1984, before the intervention began, the project conducted surveys of students leaving the 9th grade. A similar survey of the first age cohort to participate in the intervention programme took place in 1987, and another in 1988 for the second age cohort. Internal monitoring of the first age cohort at the end of the 7th grade (after one school year of intervention) was carried out in spring 1985.

The surveys took place as follows:

1. All ninth graders of the study schools in 1984, 1987 and 1988 (n = 4253) were requested to participate in a 45-minute questionnaire session at which they were to complete a 63-item self-report to identify the following items: school, class, sex, age, and aspects of behaviour.
2. From each school 16 boys and 16 girls were randomly selected for medical examination. The variables measured were: height, weight, blood pressure (by manual and/or automated methods), sexual maturity (Tanner's scale), serum total cholesterol, HDL cholesterol, and thiocyanate. Serum fatty acids were also analyzed among students at the direct intervention and control schools.
3. Children participating in the medical examination filled in an additional questionnaire assessing their health knowledge, social normative beliefs, social norms, peer pressure, skills for resisting social pressures, social support, and relationship with parents.
4. Parents of these children filled in a questionnaire on socioeconomic variables, their own health behaviour, health beliefs, risk factors, and the child's diseases and health.

School year		Grades	
	7th	8th	9th
1983-84			O
1984-85	XO		
1985-86	X	X	
1986-87	(X)	X	XO
1987-88	(X)	(X)	XO

O survey
X intervention
(X) intervention continues if shown feasible and effective

Figure 22.2. Study design in the second North Karelia Youth Project

5. Twenty-four-hour dietary recall was collected in the direct intervention and control schools from the children who participated in the medical study.
6. The nutritional content of the school diet was calculated over one month, based on the stock book kept by the school kitchen staff.

The present paper presents the effects of the programme on smoking, drinking, dietary behaviour, school diet, and serum total cholesterol.

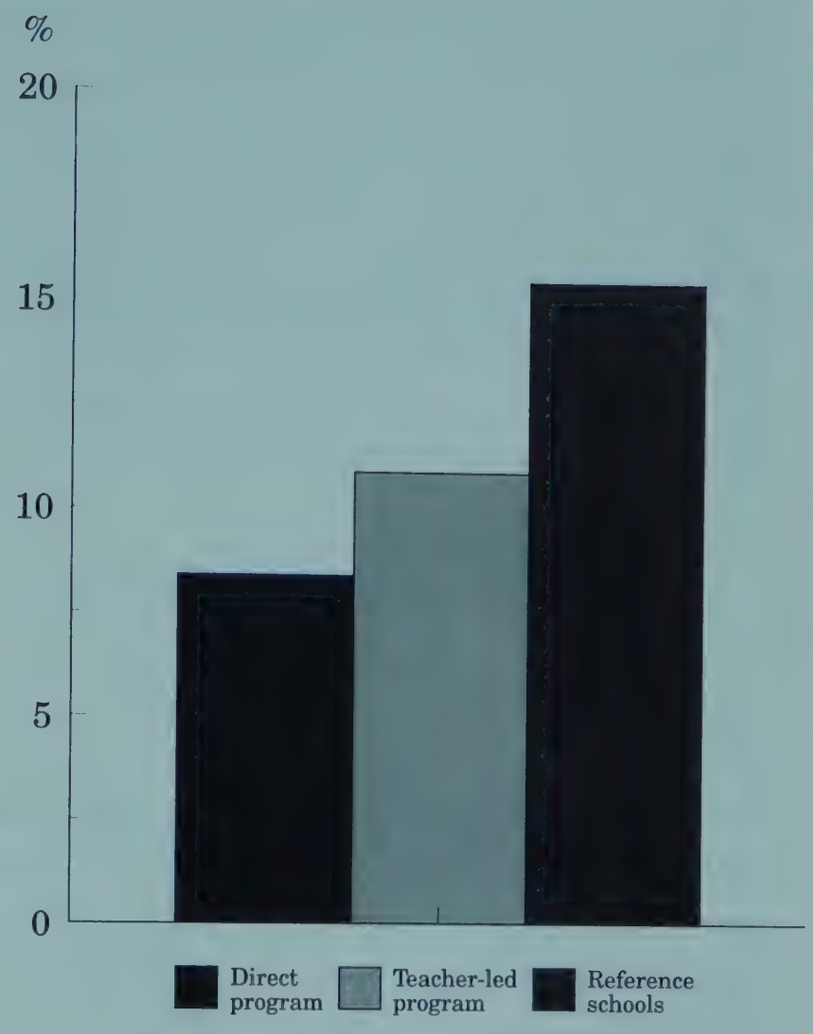

Figure 22.3. Percent of students who reported smoking at least once a week by intervention group at the end of the 7th grade

4.7. Results

4.7.1. Smoking

The short-term effects of the programme were assessed by a survey among seventh graders in spring, after one school year of the programme. At the direct programme schools 8.4% of students reported smoking at least once a week, at the teacher-led programme school 10.9%, and at the reference schools 15.5% (Figure 22.3). The direct programe schools had 49% fewer smokers and the teacher-led programme schools 30% fewer than the reference schools.

Self-reported smoking rates in the ninth grade prior to the programme and in the next two age cohorts participating in the programme are shown in Table 22.6. Daily smoking increased more or less equally in all the school groups, from 22% in 1984 to 26% in 1988, indicating that the programme effect observed in the seventh grade seemed no longer to exist in the ninth grade.

	DIRECT PROGRAMME (%)	TEACHER-LED PROGRAMME	REFERENCE SCHOOLS
1984	21.3	21.8	23.9
1987	23.3	25.3	27.5
1988	21.9	26.9	25.2
[a] Loglinear model: year, $p<0.001$; school group, $p<0.05$; year times school group, N.S.			

Table 22.6. Reported daily smoking rate in the 9th grade before the programme (1984) and in the two age cohorts (1987, 1988) participating in the programme [a]

4.7.2. Diet

Based on the questionnaire, a dietary habits index was calculated. The children were awarded one point for each of the following habits: used margarine, light spread, or nothing on bread at home or at school; drank skim milk at school or at home; used vegetable oils with salads; ate vegetables at least three times a week; ate berries or fruits at least three times a week; did not add salt to food at table.

Dietary habits assumed a positive trend in each of the school groups. The changes were greater in the direct programme and teacher-led programme schools than in the reference schools. Dietary trends in girls tended to be slightly more favorable than in boys, but the overall improvement was almost equal (Figure 22.4).

In the direct programme and reference schools the content of school lunches was calculated over a one-month period based on the stock book kept by the school kitchen staff (Table 22.7). In the direct programme schools the fat proportion decreased from 34.0 % to 31.4 %. There was no change in the reference schools. The polyunsaturated/saturated fat ratio improved in programme schools, but was unchanged in the reference schools.

The mean total serum cholesterol fell from 4.67 mmol/l (179 mg/dl) to 4.55 mmol/l (176 mg/dl) – a reduction of 2.6% and similar in all the school groups. Systolic blood pressure declined faster in the direct programme than in the teacher-led or reference schools (Figure 22.5). No effect was seen on diastolic blood pressure.

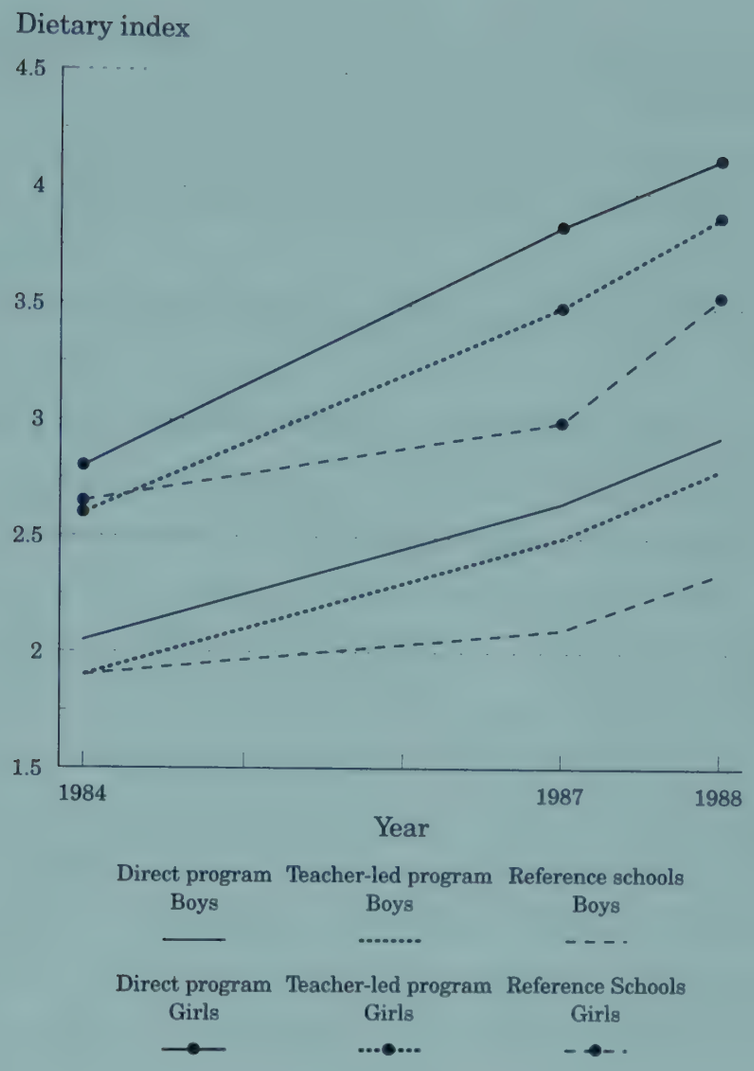

Figure 22.4. Positive dietary habits by intervention group and year

	DIRECT PROGRAMME		REFERENCE	
	BEFORE	AFTER	BEFORE	AFTER
PROTEINS	17.7 %	20.9 %	18.7 %	19.1 %
FATS	34.0 %	31.4 %	37.0 %	36.3 %
CARBOHYDRATES	48.3 %	48.6 %	44.1 %	44.6 %
IRON	1.8 mg/MJ	2.1 mg/MJ	1.8 mg/MJ	1.9 mg/MJ
VITAMIN C	14.7 mg/MJ	17.7 mg/MJ	16.5 mg/MJ	15.0 mg/MJ
SUGAR	7.0 %	5.8 %	3.5 %	5.6 %
P/S RATIO	0.16	0.25	0.16	0.14

Table 22.7. School lunch content in the direct programme and control schools before and after the programme

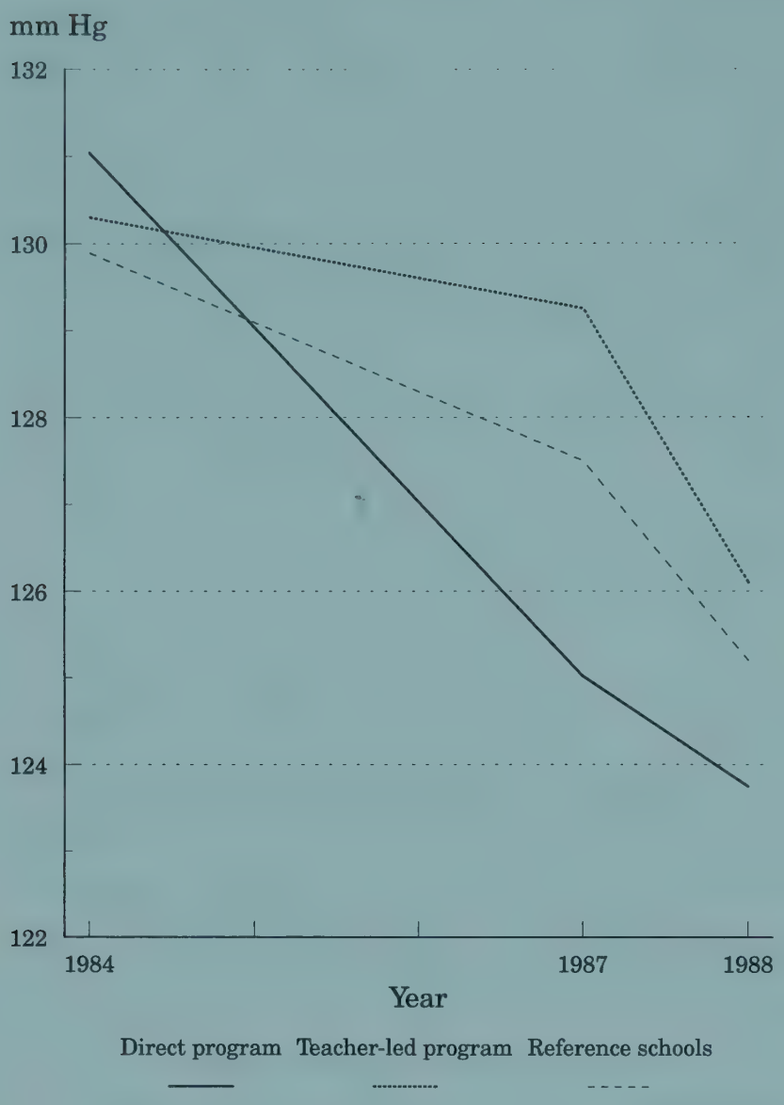

Figure 22.5. Change in systolic blood pressure by intervention group and year

5. DISCUSSION

The two family-based studies show that the high blood cholesterol level prevailing among Finnish children can be reduced by dietary changes. They also show that parents occupy a key position; in the first study only the parents' diet was actively changed, though they were told that their children could adopt the same diet. In the second study the diets of both parents and children were actively changed; however, the serum cholesterol of the children fell by about the same amount in both studies. Several other studies have shown that blood cholesterol among children can be reduced (Stein et al. 1982, Stein et al. 1975).

In the first community-based study it was possible to change the diet more in the direct programme than in the control schools. The chang-

es were greater among the girls than the boys, and this was reflected in blood cholesterol levels. In the second programme, dietary changes were greater in the direct programme and teacher-led programme schools than in the reference schools. However, the change in serum cholesterol was equal in all the school groups. It is likely that the differences in the dietary changes between the school groups were too small to reveal any effects on cholesterol level.

Cholesterol decreased in all the school groups, which is obviously a consequence of changes in the Finnish diet. Over recent years several cholesterol debates have emerged in Finland. Updated fat legislation allows manufacturers to produce a novel variety of fatty spreads and related products. The Finnish Heart Association ran a national nutrition campaign focused on cardiovascular disease. The National Board of Education produced national recommendations for the school lunch service covering the amount and type of fat in school meals. These recommendations mirrored those of our own programme. The National Health Behaviour Survey reveals positive changes in the diets of Finns. All things considered, it is quite obvious that the observed changes in cholesterol level among young people are real changes, and related to general dietary changes nationwide.

Many studies over the past 10 years have demonstrated that programmes based on the social influence approach can prevent the onset of smoking, at least in short-term follow-up (Flay 1985), and most show that it is possible to delay the onset. However, while we are still not completely clear about the most important components and mediating factors in these programmes, they are the best thing available and should be used on a routine basis in schools. Moves have begun in Finland to ensure that these programmes become installed as a normal part of the curriculum in as many schools as possible.

6. SUMMARY

Two family-based and two community and school-based studies were carried out in North Karelia in the context of the North Karelia Project. In the two family-based studies it was possible to decrease the serum cholesterol level among children by 15%, showing that the extremely

high blood cholesterol level of Finnish children is largely a consequence of the typical Finnish diet, which is high in saturated fat.

In the first North Karelia Youth Project it was possible to delay the onset of smoking among adolescents; two years after the programme smoking was about 30% less common in the intervention than in the reference schools. In the eight-year follow-up survey the effect of the teacher-delivered programme was still apparent.

In the second North Karelia Youth Project it was possible to delay the onset of smoking during the seventh grade, although no permanent effect was seen. Diet changed more in the programme school students than among those in the reference school.

These studies, all done during the last 10 years or so, show that cardiovascular risk factors can be reduced among children and adolescents. They have also contributed to the overall efforts and successes of the North Karelia Project. The next important challenge to be tackled is how to incorporate these findings in the normal school and health care system. We have initiated the National Healthy School Programme to assess the extent to which these programmes can be implemented on the national level.

REFERENCES

Flay BR. Psychosocial approaches to smoking prevention: a review of findings. Health Psychol 1985;4:449–488.

Knuiman JT, Hermus RJJ & Hautvast JGAJ. Serum total and high density lipoprotein (HDL) cholesterol concentrations in rura1 and urban boys from 16 countries. Atherosclerosis 1980;36:529–537.

Puska P, Vartiainen E, Pallonen U, Salonen JT, Pöyhiä P, Koskela K & McAlister A. The North Karelia Youth Project: evaluation of two years of intervention on health behavior and CVD risk factors among 13- to 15-year-old children. Prev Med 1982;11:550–570.

Report of the 95th Prevention of Adult Atherosclerosis during Childhood.Ross Conference on Pediatric Research. Ross Laboratories. Columbus, Ohio 43216., 1989.

Stein A, Shapero J, McNerney C, Glueck C, Tracy T & Gartside P. Changes in plasma lipid and lipoprotein fractions after alteration in dietary cholesterol, polyunsaturated, saturated, and total fat in free-living normal and hypercholesterolemic children. Am J Clin Nutr 35: 1375–1390.

Stein EA, Mendelsohn D, Fleming M et al. Lowering of plasma cholesterol levels in free-living adolescent males; use of natural and synthetic polyunsaturated foods to provide balanced fat diets. Am J Clin Nutr 1975;28:1204–1216.

Vartiainen E, Pallonen U, McAlister A & Puska P. Eight-year follow-up results of an adolescent smoking prevention programme: the North Karelia Youth Project. Am J Public Health 1990;80:78–79.

Vartiainen E, Puska P, Pietinen P, Nissinen A, Leino U & Uusitalo U. Effects of dietary fat modifications on serum lipids and blood pressure in children. Acta Paediatr Scand 1986;75:396–401.

Vartiainen E, Puska P & Salonen JT. Serum total cholesterol, HDL cholesterol and blood pressure levels in 13-year-old children in eastern Finland. Acta Med Scand 1982;211:95–103.

Vartiainen E, Puska P, Tossavainen K, Viri L, Niskanen E, Moisio S, McAlister A & Pallonen U. The North Karelia Youth Project (1984–88), prevention of non-communicable diseases: risk factors in youth. Health Promotion 1986;1:269–283.

WHO Study of the Precursors of Atherosclerosis: Protocol of a WHO collaborative project. WHO/CVD/I. World Health Organization, Geneva, 1978.

Viikari J, Åkerblom HK, Nikkari T, Seppänen A, Uhari M, Pesonen E, Dahl M, Lähde P-L, Pietikäinen M & Suoninen P. Atherosclerosis precursors in Finnish children and adolescents. IV. Serum lipids in newborns, children and adolescents. Acta Paediatr Scand Suppl 1985;318: 103–109.

Wynder EL, Berenson GS, Strong WB, Williams C, Haley NJ, Nicklas M, Mancini M & Okuni M. An American Health Foundation monograph on coronary artery disease prevention: cholesterol, a pediatric perspective. Prev Med 1989;18:323 -409.

Wynder EL, Williams CL, Laakso K & Lewenstein M. Screening for risk factors for chronic disease in children from fifteen countries. Prev Med 1981;10:121–32.

23. THE PROJECT EXPERIENCE IN THE EYES OF LOCAL HEALTH WORKERS

Ritva Mäki
and Risto Jukola

1. PUBLIC HEALTH NURSE (RITVA MÄKI)

I have worked as a public health nurse at a North Karelian health centre since the the project was launched, which coincided with the introduction of new national public health legislation. The North Karelia Project transformed the activities of public health nurses in many ways. Previously they had largely worked with children and pregnant women at the maternity and child clinics, but the new project activities meant that they now had to involve themselves more with prevention and health education among adults.

In the beginning, many of the adults, particularly men, were somewhat embarrassed to be visiting a former maternity and child clinic. Fortunately, humour managed to dissolve the initial discomfort, and nowadays visits and contacts with the preventive and health promotion services are an integrated, routine feature of life in the province.

One of the first principal activities of the project was the launch of the hypertension programme. The reorganization of hypertension care required new roles and duties of the public health nurses. Special hypertension offices (clinics) were established at the health centres, and the public health nurses assumed the main responsibility for them. People with elevated blood pressure based on the project criteria were registered, and blood pressure levels regularly monitored. In connection with these measurements we discussed with the subjects their lifestyles and health behaviour, and any appropriate adjustments they could make.

This task was challenging, but it was also diverse and rewarding. Most North Karelians at that time made their livelihood from farming, particularly dairy farming. Many hypertensive and coronary patients felt

it difficult to "abandon" the dairy products from their own farm and buy vegetable margarine from the local store. Moreover, the availability of healthy food products was far poorer than now.

For example, the choice of vegetables and low fat dairy and meat products was very narrow. The main task of the public health nurse in cardiovascular disease prevention was to teach people the practical skills to modify their health behaviour. For this purpose the project provided excellent training.

Before the project began I had worked for two years at the local community hospital, where most of the myocardial infarction patients were young or middle-aged men. I saw how much distress and economic hardship was caused when the father of the family was disabled by heart disease.

When I was treating these patients I often wondered what could be done for the health of the men before they were struck with the disease, and also how to prevent new attacks. When I carried my hospital experience into my new job as a public health nurse, I was very keen about the project activities being planned for working-aged men. The same enthusiasm emerged among my colleagues throughout North Karelia in our discussions at various project training seminars.

As public health nurses we built up a very good picture of people's everyday life on our rounds of the community: at counselling centres, at schools and in homes. Many families had had their lives seriously disrupted by disease. The systematic task of preventing heart disease we saw as the most meaningful, not only for the health of the population, but also in the context of our own overall work.

The rehabilitation (secondary prevention) work among heart disease patients began at health centres on the project's initiative. The rehabilitation groups were usually run by the public health nurse and a physiotherapist. We received training from the project on group dynamics and counselling. In the beginning we were somewhat afraid of urging infarction patients to do physical exercise, because we had earlier been taught that heart patients should be confined to bed for some time after an attack. But the training, and later on our experiences, gave us courage and confidence. Physical exercise, relaxation and health education on risk factors and health behaviours were important parts of the programme for the rehabilitation groups.

The North Karelia Project introduced regular risk factor screenings of the adult population, and these became part of our work. The project also persuaded the public health nurses to undertake an increasing number and variety of speaking engagements and advisory functions (lectures at courses, talks to heart clubs, health education groups etc).

Because smoking is such a prominent risk factor for cardiovascular diseases, when I announced my first smoking cessation group so many smokers applied that they had to be split into two groups. The work to reduce smoking remains a major activity, and is still a very fruitful one.

At the end of the 70s the North Karelia Project started its youth project, which focused on the teaching and learning of healthy lifestyles in childhood and youth. The youth projects influenced the work of the public health nurses in schools, as well as school meals, home economics teaching, general attitudes among young people towards smoking and alcohol, and school health education in general. The youth projects have generated a wealth of new ideas and measures for assisting the work of the school public health nurses. They have also provided excellent training.

The North Karelia Project has published a large volume and variety of health education materials, much used by public health nurses in their work. There have been publications on how to stop smoking, physical activity, moderate alcohol consumption, regular health examinations (risk factor measurements) and how to avoid stress. All have been most useful in providing a firm foundation for the nurses' primary work of health education and counselling.

The advice and recommendations of the project also continue to be beneficial in child and maternity counselling, in school, student and occupational health care, and also in work with senior citizens.

Research and evaluation results have been reported at regular intervals, providing fresh feed-back about the effects of the public health work on the health situation in the population. The critical review of the evaluation findings also helps personnel adjust their work practices to emphasize areas where results have not been so good.

Many of the activities introduced by the North Karelia Project have gradually assumed an essential role in normal health centre work. The lessons learned have been gradually assimilated into people's everyday habits. Apart from the health education work, this process has been backed up by effective media coverage and support, by collaboration

with food manufacturers, and by legislation.

While I have often had to defend the recommendations of the project, I have always been able to rely on the firm support of the research findings and highly positive feedback from my clients.

2. HEALTH CENTRE PHYSICIAN (RISTO JUKOLA)

I have worked as the chief physician at a North Karelian health centre from the start of the project. The bulk of primary health care in North Karelia is delivered by these municipal health centres, which employ general practitioners, public health nurses and the other personnel necessary to provide comprehensive primary health care to the municipality.

The North Karelia Project began in the same year as a reorganized health centre system was introduced by a national public health act. Thus the project brought the necessary content to this new administrative framework and directed the work.

The following summarizes what I consider we have gained from the work of the project over the years and what we have given to it.

What did we gain from the project?

* The clear scientific picture of the mortality and morbidity allowed us to appreciate the depth of the crisis in North Karelia: the project statistics and international comparisons opened our eyes to what was a major epidemic of cardiovascular diseases. This naturally focused and fortified our belief that something had to be done about it, and perhaps could be.
* We were given a scientific and theoretical basis from which to influence the lifestyle of our citizens. The project team made it clear that changing the disease situation appreciably would largely depend on significantly modifying the risk-related lifestyles of the population. The project built up an epidemiological framework for this and also created theoretical perspectives for influencing the local lifestyles.
* Practical programmes were evolved for carrying out health education within the scope of primary health care work. Based on the

theoretical models developed by the project, often with our collaboration, several very practical programmes were planned for integration into normal health centre activities. These ideas were communicated in the form of guideline papers, discussed at the various training seminars and adjusted according to the expert advice received. The implementation was also integrated into the administrative frameworks. In addition, the project gave us the necessary feedback.

* We received influential support for developing our preventive health work. In the early years of high morbidity and scarce health care resources, the health authorities were naturally very concerned to provide the necessary therapy to the numerous patients. The project gave us influential support when we emphasized the need for simultaneous preventive activities. This meant new posts to be filled, as well as additional financial resources and facilities.
* Our epidemiological understanding of major chronic diseases was enhanced. In the years prior to the project cardiovascular diseases were regarded as a natural part of everyday life in North Karelia; manifestations of heart disease were taken as an inevitable sign of aging. The project reversed these perceptions and helped us understand the epidemiology and causal factors. We started to learn how atherosclerotic cardiovascular diseases develop, what their main causal risk factors are, and how we could actually prevent them by eliminating these factors.
* We developed friendships and channels of influence. The project organized numerous meetings and seminars for North Karelian doctors. We learned to know each other better, and there was a feeling of a common task and commitment. The project also had broad and effective links with national experts and health authorities, as well as with many international experts and organizations. We were also exposed to many of these contacts, which gave us new avenues of influence. Having the background of the project often made it easier for us to contact the national health authorities and raise our problems and needs.
* We perceived new importance and meaning in our work. We were no longer merely treating the patients appearing in front of us – now we could significantly contribute to the fight against new chron-

ic disease epidemics. The health centre physicians occupied a key position as local experts in the work of the project, and were much in demand as consultants by a variety of local organizations. Many of the project's practical studies have involved local health centres in various ways, which often allowed health centre doctors to have direct contact with the scientific work. This provided an interesting contrast to routine patient care.

What did we give to the project?

* We gave our population for intervention and research purposes. In numerous ways we helped the project gain full access to our population for the preventive work and the necessary surveys and other investigations.
* The project had access to our personnel when needed. The evaluation surveys, many other project investigations and numerous other activities needed the practical help of our staff. We always tried to make them available whenever possible.
* Our health centre facilities were also made available. The project had no offices in the province's municipalities. The local health centre building thus often became the local facility for project activities; not only the population surveys and many other specific trials, but also numerous intervention activities. The facilities and other resources were at their disposal whenever possible.
* The project received our own work input. Achievement of the project objectives very much depended on the work of all the personnel at the health centres. Whenever time dictated a competition of needs we tried to do the project-related work as much as possible. This particularly concerned the huge efforts that went into the detection, treatment and follow-up of hypertension, as well as the measurement of other risk factors, and counselling etc.
* The cooperation was good. We always tried to cooperate as far as possible with the project and its representatives. It was obvious to us that effective collaboration was a mutual interest.
* The project received a mixture of criticism and approval. We gave feedback to project team members and other representatives whenever we met (personal contacts or training seminars). They got real-

istic, constructive criticism about our experiences, but we also expressed our gratitude and satisfaction whenever possible.

Conclusion

Finally, I conclude that we received much more from the project than we gave. Another way to express it is that the project enabled us to produce more health than we would have by merely treating disease.

24. THE ROLE OF THE NORTH KARELIA PROJECT IN MODERN PUBLIC HEALTH

Alfred McAlister

The North Karelia Project may be seen as a harbinger of a second public health revolution (e.g., McAlister & Green, 1984). The first public health revolution came when unsanitary environments were recognized as causes of diverse infectious diseases and engineering solutions were applied to serve populations in economically developed countries. This revolution is far from over, but it has radically improved the well-being of those who have participated in it.

The second public health revolution has come as behaviour and life-style are recognized as causes of chronic disease and social change campaigns are applied to change the behaviour of whole populations. We are only in the first few decades of this revolution and its eventual form cannot be clearly foreseen, but the experience in North Karelia is encouraging.

Epidemiological studies in North Karelia have been translated in to action; success is possible in efforts to change ingrained habits such as diet and tobacco use. The experience also shows that with an effective political system, public health leaders can gain authority to strenuously exert influence over personal behaviours without arousing undue resistance. In North Karelia this was accomplished through a blended approach which included both manipulation and empowerment (McAlister et al. 1991).

The project had specific goals with respect to tobacco and fat consumptions and it openly advocated policies such as taxation and restriction. But that advocacy was conducted primarily through education and persuasion to gain popular support, rather than by imposing them through central authorities.

As individuals and communities came to accept the project's recommendations, an effort was made to enhance their personal or political

capacities for change. Such activities included televised instruction in skills for non-smoking or for growing vegetables. The work also included extensive organization and networking to recruit and give voice to emerging local advocates in the communities of North Karelia.

The project built an education and advocacy organization of lay leaders which involved over a thousand people, nearly one in every hundred adults, at all levels and locations (Puska et al. 1986). This process undoubtedly accelerated improvements in health services for control of hypertension and it stimulated voluntary policies to restrict smoking which later became national legislation. It has also helped shape an agricultural and economic transformation to reduce dependence on dairy and beef production by promulgating fish and berry farming, including economic support for converting operations without loss of independence of family farms.

The "revolution" in North Karelia may have begun as a radical movement within an elite group of public health scientists. But, like all successful social transformation, it has also been a popular revolution at the "grass-roots" of the society.

The North Karelia Project shows that behavioural science in public health can make contributions just as the physical sciences helped meet the engineering challenges of sanitary reform. Our experience has confirmed the oft-quoted mid-century remark of the applied psychologist, Kurt Lewin that, "There is nothing as practical as a good theory." What we have found to be useful is the social-cognitive learning theory espoused by Albert Bandura of Stanford University (Bandura 1986).

The notion of blending manipulation and empowerment noted in the previous paragraph is based upon Bandura's emphasis on human capacities and on the reciprocal influences between people and their environments. This idea synthesizes seemingly opposing viewpoints such as those of B.F. Skinner (1971) and Paolo Freire (1972) and does away with unnecessary arguments about voluntary versus structural change.

The notion of reciprocal interaction helps make it clear that environmental changes which manipulate behaviour must be brought about through voluntary advocacy behaviours that depend upon political structures which give people the capacity to control their environments. A less philosophical concept from Bandura's theory is the idea that most human learning occurs through observation and imitation.

This observation has an obvious implication for a social change campaign. Rather than telling people what to do through prescription, we need to show people what other people are doing through exemplification. This provided the basis for our successful television instruction series Keys to Health, which portrayed the real-life experiences of North Karelians as they stopped smoking or changed eating habits (Puska et al. 1987). While Bandura's theory views new behaviours to be acquired through observation of models it holds that the performance of those behaviours is dependent upon incentives or expectations of reinforcement and that one of the most influential incentives is the direct expression of approval from our peer groups. Bandura posits the dual-link notion of how innovations are diffused in a population through a combination of the mass communication of "role models" and provision of social reinforcement within interpersonal communication networks.

This theory provided the basis for combining the television and other mass media activities with the lay leaders organization, which provided role models and a network for activating social reinforcement at the "grass-roots" level. The theory-based combination of mass communication and community organization in North Karelia was a valuable device for accelerating the diffusion of health innovation that can be applied to other public health problems requiring population-level behaviour (McAlister 1991).

We have found that theory can be used to construct practical activities of many kinds. The reorganization of health services, based on the idea of reciprocal influence and shared responsibility between the individual and the health care system, was carried out by creating new roles for public health nurses that have now become standard practice. The organization of the lay leader movement, which required much time and perseverance, involved personal contacts, group discussions and publicity events that are familiar to politicians in most participatory political systems. Eventually it came to involve formal political activity, with Professor Puska elected to parliament and helping obtain national support for local needs such as those arising from the conversion of dairy to fish and berry farming (Kuusipalo et al. 1986). A major and successful advocacy objective was restriction and taxation of tobacco use and this included dedication of tax revenues that continue to support the project activities.

The idea of raising tobacco taxes and dedicating part of the revenue to anti-smoking and other public health activities has recently been adopted in California, where it is credited with a significant reduction in tobacco use. Another very practical and useful action was the theory-based use of television, both to promote personal behaviour change and to stimulate advocacy activity at the grass-roots level. The Keys to Health series constructed as an adaptation of existing journalistic and popular formats, including aspects of panel discussions, human interest exposé and serialized drama. Although it was designed to entertain and to attract an audience, the series was treated as a news and public interest feature and produced by a team of journalists and experts in serious documentary television.

The North Karelia Project has itself been a model for imitation and acceleration of similar activities around the world. It has had a powerful impact in the United States. Major research studies in California, Minnesota and Rhode Island funded by the National Heart Lung and Blood Institute have used methodologies and received extensive consultation from Finnish scientists, although the success in North Karelia has been difficult to match.

One community study of smoking cessation on the Mexican border in Texas that was supported by the National Cancer Institute was explicitly modeled after the North Karelia Project (McAlister et al. 1992). The combination of peer modeling communication and peer network organization demonstrated in Finland has also been adapted to community-level HIV prevention campaigns in ten U.S. cities, in a programme of research supported by the Centers for Disease Control and Prevention (O'Reilly & Higgins 1991, Guenther-Grey et al. 1992).

The North Karelia Project has also served as a prototype for international studies sponsored by the World Health Organization. These include the MONICA Project in which 22 countries are monitoring trends in cardiovascular diseases, with the Finnish research team acting as the international Data Centre. The North Karelia Project also provides leadership for the European CINDI projects and for the global Interhealth Demonstration Projects (McAlister et al. 1991), again as a coordinating center. This latter activity has led to partial replications of the project in Mauritius, China, Russia, Tanzania, Malta, Chile and Cuba, with work in development in several other countries. Hundreds of scientists from

around the world have visited North Karelia to learn from the experiences there and many partial replications are being carried out independently.

At least two developments are foreseeable as the North Karelia Project and similar projects continue their activities into the future. There will certainly be adjustments in messages, particularly in recommendations about nutrition, as new studies shed further light on the role of fat and micronutrients in cancer, cardiovascular disease, diabetes and other diseases. As knowledge grows, revision of accepted beliefs is inevitable and we must learn to change recommendations without losing credibility among skeptics.

As epidemiological findings and their consequent recommendations become more precise for particular disease processes, the public health objectives of our work are becoming broader. The North Karelia Project's original goal exclusively concerned reductions in cardiovascular disease. Recognizing the overlap between cardiovascular risk factors and those for other diseases, e.g., smoking, the disease reduction goals have been expanded.

Research and measurement activities of the North Karelia Project now involve several major forms of chronic disease in Finland. Virtually all health problems and many social ills, such as injury and violence, are involved as moderation of alcohol use is included among the goals of the action research in North Karelia. In Finland it has been possible to use the methods and structures originally developed to meet the challenge of cardiovascular disease to promote other health behaviour changes, e.g. use of condoms to prevent HIV infections.

This flexibility is not matched in countries where epidemiology and prevention are tightly confined by disease categories. In the U.S.A., where the National Institutes of Health are divided by disease categories, the major community studies of cardiovascular disease prevention have run their course and ended without expanding to even study the most closely related diseases. Entirely new studies have been constructed, at very great expense, for smoking control to prevent cancer (Lichtenstein et al. 1991).

The science of public health is rapidly refining and broadening its objectives. Action to address some emerging concerns, e.g. social support, life satisfaction, aggression, sexuality, will require collaboration

across disciplines and action settings. To meet these needs the North Karelia Project must become even more flexible and complex. Our greatest future challenge is to accomplish this growth while maintaining progress on our initial goals.

REFERENCES

Bandura A. Social Foundation of Thought and Action. Prentice-Hall, Englewood Cliffs, New Jersey, 1986.

Freire P. Pedagogy of the Oppressed. New York, Herder & Herder, 1972.

Guenther-Gray C, Tross S, McAlister A, Freeman A, Cohn D, Corby N, Wood R, Fishbein M: AIDS community demonstration projects: Implementation of volunteer networks for HIV-prevention programs – selected sites 1991–1992. Morbidity and Mortality Weekly Review 1992;41:868-869, 875–876.

Kuusipalo J, Mikkola M, Moisio S, Puska P. The East Finland Berry and Vegetable Project: A health-related structural intervention programme. Health Promotion 1986;1:385–391.

Lichtenstein E, Nettekoven L, Ockene J. Community intervention trial for smoking cessation (COMMIT): Opportunities for community psychologists in chronic disease prevention. American Journal of Community Psychology, 1991;19(1):17–38.

McAlister A: Population behavior change: A theory-based approach. Journal of Public Health Policy 1991;12(3):345–361.

McAlister A and Green, L: New approaches to the promotion of public health and safety. L.B.J. School of Public Affairs Comment 1984;30(4).

McAlister A, Nissinen A, Berrios X, et al. Demonstration projects for the integrated prevention and control of noncommunicable disease (INTER-HEALTH Programme): Epidemiological background and rationale. World Health Statistics Quarterly 1991;44(2):48–54.

McAlister A, Orlandi M, Puska P, Zbylot P and Bye LL. Behavior modification in public health: Principles and illustrations. In Holland, W.W., Detels, R. and Knox, E.G. (Eds.) Oxford Textbook of Public Health. London: Oxford Medical Publications 1991.

McAlister A, Ramirez A, Amezcua C, Pulley L, Stern M. and Mercado S. Smoking cessation in Texas-Mexico border communities: A quasi-experimental panel study. American Journal of Health Promotion 1992; 6(4):274–279.

O'Reilly K, Higgins D. AIDS community demonstration projects for HIV prevention among hard-to-reach groups. Public Health Reports 1991;106:714–720.

Puska P, Koskela K, McAlister A, Mäyränen H, Smolander A, Moisio S, Viri L, Korpelainen V and Rogers EM. Use of lay opinion leaders to promote diffusion of health innovations in a community programme: Lessons learned from the North Karelia project. Bulletin of the World Health Organization 1986;64(3):437–446.

Puska P, McAlister A, Niemensivu H et al. Keys to Health: Television format for national public health promotion. Public Health Reports 1987; 102(3):263–269.

Skinner BF. Beyond Freedom and Dignity. New York, Knopf 1972.

25. INTERNATIONAL COLLABORATION IN THE NORTH KARELIA PROJECT

Aulikki Nissinen

The historical Seven Countries Study began in 1959 in an eastern region of North Karelia called Ilomantsi. The study provided a training ground for young Finnish investigators in cardiovascular epidemiology, and served as a sound basis for international collaboration in the field. Epidemiologists everywhere were soon to become aware of the burden of coronary heart disease in Finland (The Seven Countries Study, 1994, Toshima et al. 1995).

The framework for the study design of the North Karelia Project was conceived at an international meeting of experts in 1971 coordinated by the World Health Organization (WHO)(Puska et al. 1981). The research plan to emerge was the practical response to the petition from the people of North Karelia. Since then, collaboration with WHO has remained intensive. The project's hypertension programme, together with those initiated by 12 other centers, took part in the WHO global programme "Community Control of Hypertension" (Ambrosio et al. 1988).

The experiences of the project formed the basis of the WHO-European programme "Comprehensive Community Control of Cardiovascular Diseases", launched in 1977 (Puska et al. 1988). Altogether, nine countries in the WHO European region implemented the CVD-programmes, using a common protocol for the scientific evaluation.

Since then the North Karelia Project has spearheaded the planning and operation of the European CINDI programme (Countrywide Intervention for Prevention of Non-Communicable Diseases) (Leparski et al. 1987). In addition, the global InterHealth-programme (Integrated Programme for Prevention and Control of Chronic Diseases) was launched in the mid-1980s (InterHealth 1991). The InterHealth-programme involves both developed countries as well as developing nations such as Tanzania, China, Chile, Cuba, Mauritius, Sri Lanka and Thailand. The

programme's protocol for the effect evaluation uses the methodology adopted from the WHO-Monica project for measuring lifestyle-related factors (WHO 1988). Coordination of the evaluation is by the National Public Health Institute (KTL) in collaboration with the University of Kuopio.

Since 1982 the WHO-Monica project has evolved into an important data source and forum for training in CVD-epidemiology. The data centre of the project operates at KTL and is maintained financially by the Finnish Ministry of Social Affairs and Health.

The North Karelia Project has provided the foundation for numerous other research projects, such as EWPHE, SYSTEUR and INTERSALT. Collaboration with the U S Department of Agriculture has contributed a series of dietary investigations (USDA-studies) for testing the effects of modifying dietary fat composition on blood pressure (Puska et al 1983).

In early 1990 collaboration began with Estonia and the Russian Republic of Karelia. The risk profiles of chronic diseases have been measured using a common protocol. The preliminary data show that health behaviour in the Republic of Karelia is more or less on the same level as in the North Karelian population early in the 1970s.

Since 1979, around 500 scientists and health care workers have taken part in the North Karelia Visitors Programme organized biannually in collaboration with WHO.

International experts visiting North Karelia have had a vital role in training the project team's research personnel and the province's health care workers.

Experiences gained in the North Karelia Project have also been disseminated via the numerous consultancy positions held by members of the project research team – as experts in WHO working groups and as officials in the Organization.

REFERENCES

Ambrosio GB, Strasser T, Dowd JE, Tuomilehto J, Nissinen A, Froment A, Milon H, Miguel JMP, Macias-Castro I, Dondog N, Zamboni S, Dal Palu C. Effects of interventions on community awareness and treatment of hypertension:

results of a WHO study. Bulletin of the World Health Organization 1988;66(1):107–113.

InterHealth Steering Committee. Demonstration Projects for the Integrated Prevention and Control of Noncommunicable Diseases (InterHealth Programme).Epidemiological Background and Rationale, World Health Stat.Q. 1991;44:48–54.

Krombout D, Menotti A, Blacburn H (eds.). The Seven Countries Study. A scientific adventure in cardiovascular disease epidemiology. Utrecth, the Netherlands, 1994.

Leparski E, Nüssel E (eds.). CINDI (countrywide integrated noncommunicable diseases intervention programme). Protocol and guidelines for monitoring and evaluation procedures. Berlin (West), Springer Verlag, 1987.

Puska P et al. Community control of cardiovascular diseases: evaluation of a comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland, 1972–1977. Copenhagen, WHO Regional Office for Europe, 1981.

Puska P, Iacono J, Nissinen A et al. Controlled randomized trial of the effect of dietary fat on blood pressure. Lancet 1983;1:1–5.

Puska P (ed.). Comprehensive cardiovascular community control programmes in Europe. Copenhagen, WHO Regional Office for Europe, 1988 (EURO Reports and Studies No. 106).

Toshima H, Koga Y, Blackburn H, Keys A (eds.). Lessons for Science from the Seven Countries Study. A 35-Year Collaborative Experience in Cardiovascular Disease Epidemiology. Tokyo, Japan, 1994.

WHO MONICA project principal investigators. The World Health Organization MONICA project (monitoring trends and determinants in cardiovascular disease): a major international collaboration. Journal of Clinical Epidemiology 1988;41(2):105–114.

26. COMMUNITY-BASED HEART DISEASE PREVENTION: THE AMERICAN EXPERIENCE

Thomas E. Kottke

1. BACKGROUND

The roots of the community-based heart disease prevention trials lie in a Finnish-American collaboration that started almost two decades before the formation of the North Karelia project. Ancel Keys had been evolving and testing the diet-heart hypothesis since at least 1947, and about this time Keys was introduced to Martti Karvonen when they were members of committees of the World Health Organization and United Nations Food and Agriculture Organization (Keys 1980). In 1956, with the comparison of ostensibly healthy men in east and west Finland, these two men initiated an international collaborative effort to define the causes of the coronary heart disease epidemic.

Three years later, all 40 to 59 year old men in selected communities in east and west Finland and a group of railroad workers in the United States were selected to become cohorts of the Seven Countries study (Keys 1980). The subjects were examined for the presence of cardiovascular diseases and for smoking, serum cholesterol, dietary habits, physical activity, and other potential cardiovascular disease risk factors. These initial physical examinations documented that the prevalence of cardiac and vascular disease was much higher in Finns and Americans than in the other cohorts.

The first follow-up in 1964 confirmed the high incidence and mortality rates from coronary heart disease and demonstrated that a diet high in animal fat, along with elevated blood pressure and smoking, were associated with these high rates. From the results of the ten-year examination of the Seven Countries Study cohort that took place in 1969, it was apparent that the high rates of coronary heart disease in

Finland and the United States were due to behavioural and biological risk factors, not to the genetic background of the populations.

After the results of the Seven Countries Study were reported, events moved rapidly in Finland. As described elsewhere in the monograph, government officials in North Karelia petitioned for national aid in January 1971, and in September of the same year, the Finnish Heart Association sponsored a planning seminar in Joensuu. Seminar participants, including internationally-recognized heart disease prevention experts from the United States, recommended that heart disease in North Karelia be viewed as a community problem to be solved through community action. The North Karelia Project was initiated in 1972.

The Americans who attended the North Karelia Project planning seminar found that the concept of community-based intervention was neither rapidly nor easily accepted in the United States. The scientific community was not satisfied with the evidence that preventing or treating smoking, hypertension, and hyperlipidaemia would prevent heart disease and insisted that etiologic trials directed at individuals be conducted.

Therefore, while the Lipid Research Clinic trial, the Hypertension Detection and Follow-up Program and the Multiple Risk Factor Intervention Trial were being undertaken as single and multi-factor randomized trials of the risk factor hypothesis in individuals, the research teams of Farquhar, Blackburn, and Carleton developed their arguments for community-based interventions. These projects eventually became three programmes sponsored by the National Heart Lung and Blood Institute of the National Institutes of Health. As such, they sought to share principles of intervention and to develop evaluation methods that would allow comparison of results across the three projects.

2. THE STANFORD HEART DISEASE PREVENTION PROGRAMME

The philosophy of community-based intervention that Farquhar developed in the late 1960s and early 1970s (Farquhar 1978) resulted in two community-based intervention trials from Stanford University: The Three Community Study (Farquhar 1977) and the Five City Project (Farquhar 1985). The Three Community Study was initiated in 1972 in three northern California towns. One community received mass media campaigns over a 2-year period and one community received the mass media campaigns plus face-to-face counselling for a small subset of high-risk people. A third community served as a control. To assess knowledge and behaviour related to cardiovascular disease, and to measure physiological indicators of risk, people from each community were interviewed and examined before the campaigns began and one and two years afterwards (Farquhar 1977).

The investigators found that the predicted risk of cardiovascular disease increased over two years in the control community, but there was a decrease in predicted risk of 15 % to 20 % in the treatment communities. The Three Community Study did not attempt in measure the impact of the intervention on morbidity and mortality.

The Stanford Five City Project was implemented in 1980 (Farquhar 1985). Two treatment cities received continual exposure to general education. This exposure was punctuated by four to five separate risk factor education campaigns per year that advocated five behaviour changes: reduction in plasma cholesterol levels, reduction in blood pressure, reduction in cigarette use, weight control, and increase in physical activity. Three cities served as control communities. The impact of the intervention on risk factor levels was assessed in cohorts followed for the duration of the study and in a series of independent samples.

The net changes in knowledge were approximately the same for both the cohort and the independent samples (Figure 26.1) (Farquhar 1990). A larger effect was observed in the cohort samples. With the exception of smoking, the pattern of change for the independent samples strongly resembled the pattern of change observed for the cohort sample. The net decline in smoking was much greater in the cohorts. While the changes in risk factor levels tended to reach statistical significance in the cohort samples, they tended not to reach statistical significance in the independent samples. Morbidity and mortality outcomes for this project have not yet been reported.

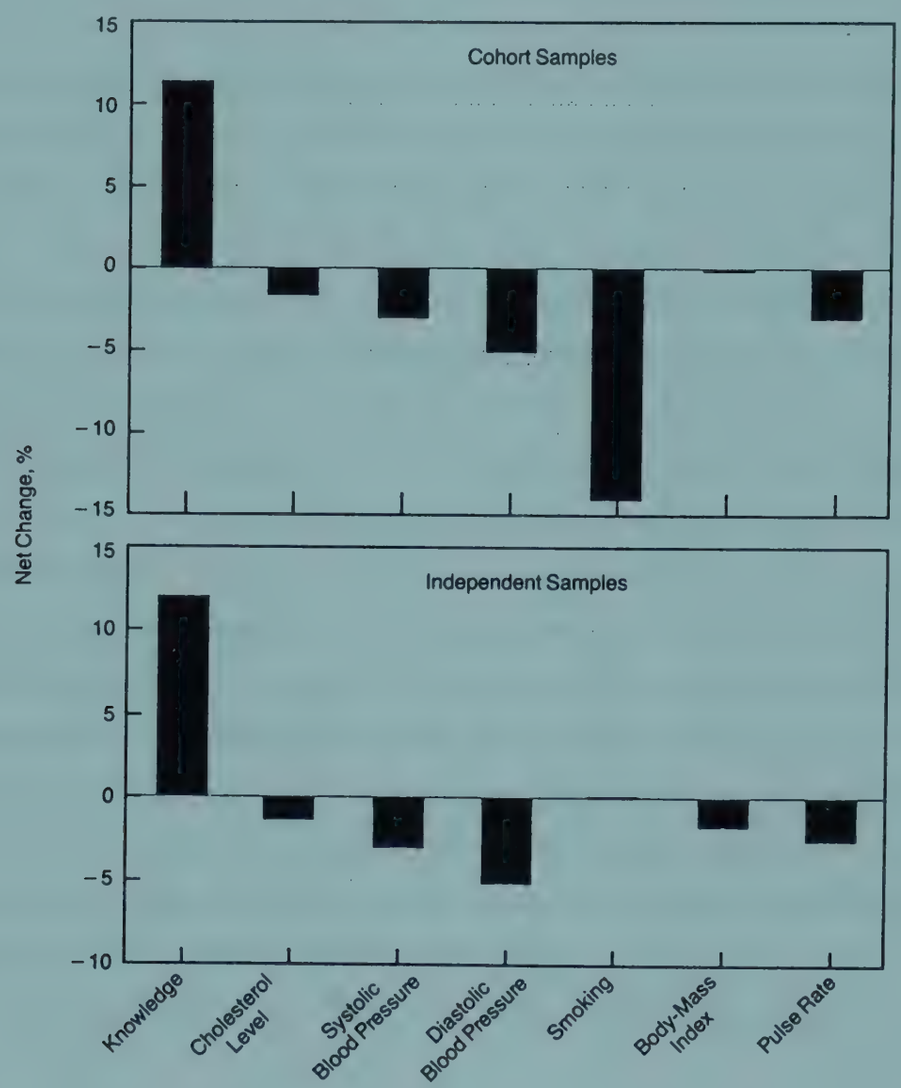

Figure 26.1. Net percentage change for knowledge and risk factors after education for persons aged 25 through 74 years in the Stanford Five City Project. Top, For cohort samples, a difference score is obtained by comparing values for each individual at baseline with the mean of that individual's values at the last two surveys. Bottom, The independent sample compares the baseline survey with the mean of the two last surveys. From: Farquhar JW, Fortman SP, Flora JA et al. Effects of community-wide education on cardiovascular disease risk factors. The Stanford five-city project. JAMA 1990;264:359–365, with permission.

3. THE MINNESOTA HEART HEALTH PROGRAM

The Minnesota Heart Health Program (MHHP) was a 9-year cardiovascular disease prevention research and demonstration programme (Blackburn 1984). The intervention and evaluation took place in three pairs of communities between 1980 and 1989. The MHHP attempted to produce the strongest possible inference about the effects of community education as a valid alternative to a randomized controlled experiment. A randomized trial was not considered feasible. Inference was based on deduction from simultaneously measured trends of health behaviour, risk factor levels, and morbidity and mortality rates. An attempt was made use the evaluation process to link all of these to the educational programme and process. As described by the investigators (Blackburn 1984) the educational campaigns included the following systems:

- Mass communication (mass and personalized media).
- Direct education through the Health Education Center and special adult classes.
- Professional education through workshops for physicians, dentists, nutritionists, nurses, and other health professionals.
- Youth education programs through school curricula, 4-H clubs, youth campaigns, and children's events.
- Community-based activities implemented by campaign task forces on smoking, exercise, and eating patterns and on special worksite and medical center projects.

Constrained both by the number of intervention units (towns) that were available and by limited resources, the MHHP investigators recognized that their design lacked the strength of a randomized clinical trial with a large number of intervention units. They therefore used several methods to strengthen inference about programme effects (Blackburn 1984):

- Comparison of educated and non-educated communities of similar size and complexity.
- Staggered campaigns in the three educated communities, adding strength of inference from repetitions.
- Measurement of differences in risk factors, behaviour, and disease trends among samples in the educated communities pooled, versus the comparison populations pooled.

- "Before and after" analyses of sample cohorts that have particular risk configurations or are exposed to different intensities of the educational messages.
- Standardized outcome measures throughout, so that the results from the MHHP and the two other NIH-sponsored programmes could be pooled for endpoint events and would be internally consistent for risk factor measurements.
- A design that incorporated a shakedown period of development, organization, and function before major population exposure.
- Numerous evaluations of the links between educational efforts, community behaviour, and disease risk.

The evaluation documented that during the intervention period the comparison communities were receiving constantly increasing doses of education about CHD prevention (Figure 26.2) (Luepker et al.). Only

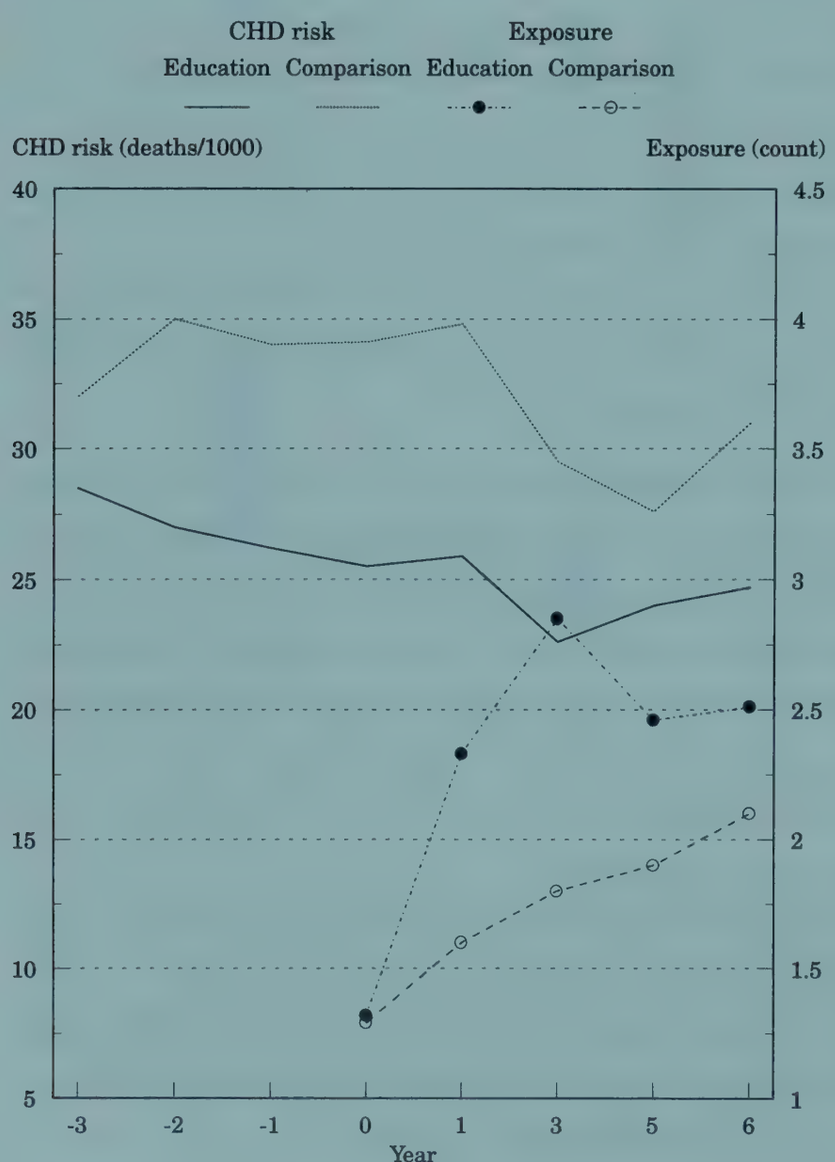

Figure 26.2. Coronary heart disease risk levels and education exposure scores for cross-sectional surveys in the education and comparison communities during the Minnesota Heart Health Program. Year 0 is the beginning of the intervention. Modified from Luepker RV, Murray DM, Jacobs DR et al. Community education for cardiovascular disease prevention: risk factor changes in the Minnesota Heart Health Program. Am J Public Health, in press, with permission.

during years one and three of the intervention were education exposure scores significantly higher for the education communities than for the comparison communities.

There was also a significant secular trend in declining coronary heart disease risk in the comparison communities. Despite their efforts, the MHHP investigators were unable to produce a greater decline in the education communities. While morbidity and mortality outcomes have not been reported, it is unlikely that there will be significant differences in trends between education and comparison communities.

4. THE PAWTUCKET HEART HEALTH PROGRAM

The Pawtucket Heart Health Program (PHHP) was a community-based intervention trial in Pawtucket, Rhode Island, a blue collar community with an estimated population of 72,000 (Carleton 1987). The funded intervention began in late 1983, peaked in 1985, and ceased early in 1991. A nearby community of similar size served as the comparison community. The goal was to produce a 6 % reduction in average total cholesterol; 6 mmHg reduction in average systolic blood pressure; 30 % reduction in the proportion of active smokers; 2 % reduction in body weight and body mass index; 2 mg/kg/min increase in estimated maximal oxygen uptake; and a 15 % reduction in total (fatal and non-fatal) cardiovascular disease event rates. Similar to the other community-based programmes, the educational effort employed indigenous organizations and volunteers and included attempts to change the social environment through small group programmes, self-help materials, screening, counselling, and referral.

Based on the Framingham formulas for risk of myocardial infarction, stroke, or sudden death, overall risk fell by 12 % in Pawtucket and rose by 4 % in the comparison community at the peak of the programme intervention ($p<.05$)(Carleton 1994). The differences in calculated risk between the two communities declined by the end of the project period (RA Carleton, personal communication, June 9, 1994). Actual morbidity and mortality results have yet to be reported.

5. INTERPRETATION

Some observers believe that the results of the trials in the United States indicate that community-based intervention is not effective and that we need to focus on the high risk and those who are already ill (Hully 1992). However, this observer believes that when interpreted in the broader context of coronary heart disease in America, the data are more consistent with a conclusion that community-based programmes can change heart disease rates.

The coronary heart disease epidemic in the United States started about 75 years age. Following a marked decline in the proportion of dietary calories that were contributed by grains, death rates from CHD rose more than ten-fold between 1925 and 1960 (Slattery). For men, the CHD death rates stabilized during the 1960s and declined steeply during the 1970s and 1980s (Figure 26.3) (Thorn 1992). The declines started at least a decade earlier among women.

The experience of the Twin Cities of Minneapolis-St. Paul is a particularly well documented reflection of the experience in the entire coun-

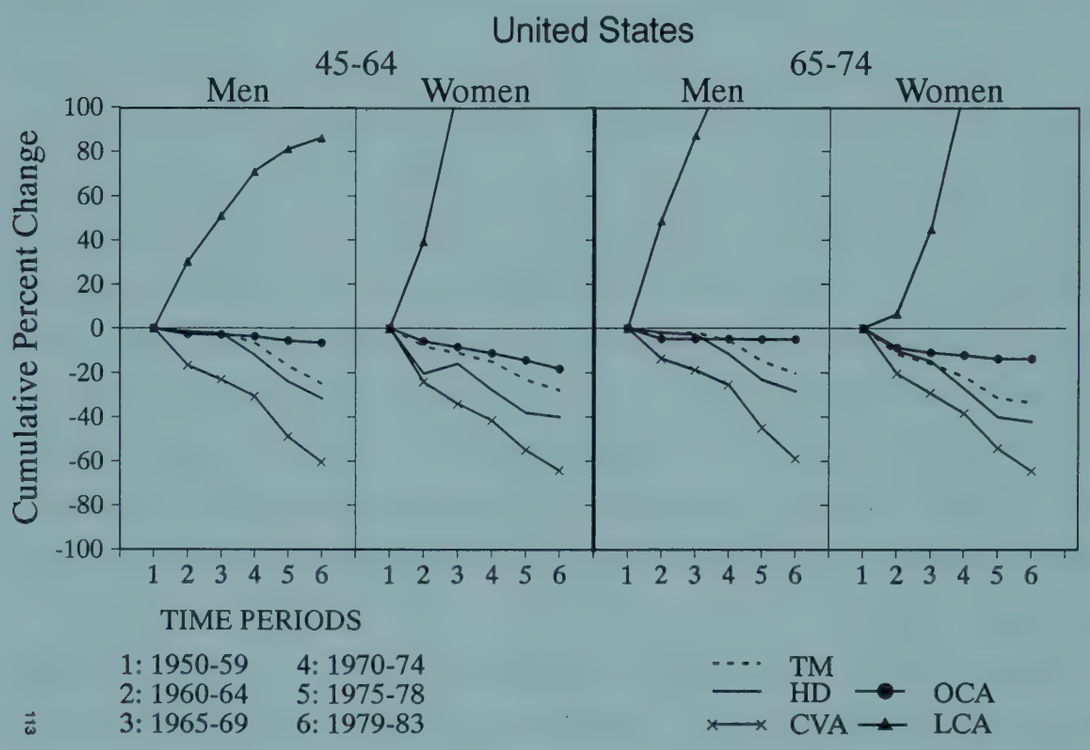

Figure 26.3. Cumulative percent change since 1950-59 for the United States in total mortality (TM) and death rates from heart disease (HD), stroke (CVA), lung cancer (LCA), and other cancer (OCA). From: Thorn TJ, Epstein FH, Feldman JJ, Leaverton PE, Wolz M. Total mortality and mortality from heart disease, cancer, and stroke from 1950 to 1987 in 27 countries. Highlights of trends and their interrelationships among causes of death. Bethesda, MD; National Institutes of Health, NIH Publication Number 92–3088, 1992, with permission.

try. Among 30 to 74 years old residents, age-adjusted CHD mortality rates declined 52 % in men and 58 % in women between 1968 and 1986 (Burke). Much of the decline was attributable to declines in out-of-hospital death. Hospitalization rates for acute myocardial infarction did not change much between 1970 and 1985, but case fatality declined consistently.

As has been the case in Finland (Vartiainen 1994), declines in mortality have been associated with declines in risk factor levels in the United States. In the Twin Cities for example, average total serum cholesterol levels decreased by 8 mg/dl in men to 198 mg/dl and 11 mg/dl in women to 189 mg/dl between 1973 and 1987 (Burke). (At enrollment in 1960, the median serum cholesterol level of the Seven Countries Study United States Railroad cohort was approximately 240 mg/dl [Keys 1980]). Cigarette smoking prevalence declined from approximately 40 % to 30 % during the same time period. Average systolic blood pressure declined by 1 mmHg and average diastolic blood pressure declined by 2 mmHg.

There is good evidence to conclude that the community studies were conducted within the context of a nation-wide community intervention. The National High Blood Pressure Education Program was organized in 1972 (National High Blood Pressure Education Program 1992) and was associated with a marked improvement in blood pressure control (Rocella) (Figure 26.4A). Since 1969, the Surgeon General of the

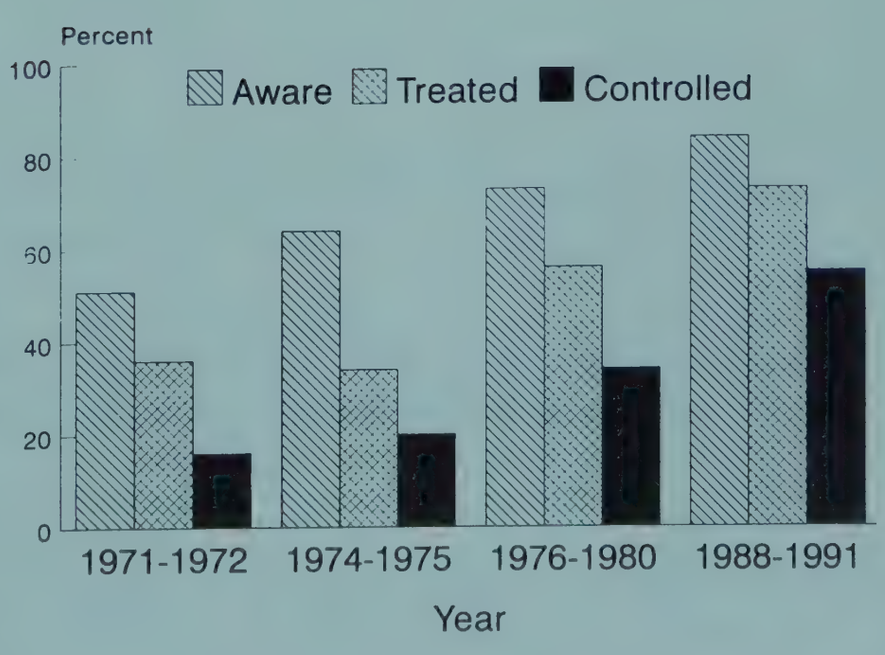

Figure 26.4A. Trends in blood pressure awareness and control in the United States. From: Gillum RF: Trends in acute myocardial infarction and coronary heart disease death in the United States. J Am Coll Cardiol 1994;23:1273–1277, with permission.

Public Health Service has issued annual reports on smoking and health. These reports, along with an aggressive non-smokers' rights movement, have resulted in a marked decline in cigarette consumption in the United States (Bartecchi) (Figure 26.4B).

The organization of the federally-sponsored National Cholesterol Education Program (The Expert Panel, 1988) resulted from the multiple lipid lowering trials that were reaching the American people and the American Heart Association's active promotion of dietary changes (AHA 1978). This debate over diet, lipids, and heart disease has been associated with a decline in average serum cholesterol levels of almost 10 % between 1960 and 1990 (Johnson 1993)(Figure 26.4C). It must also be

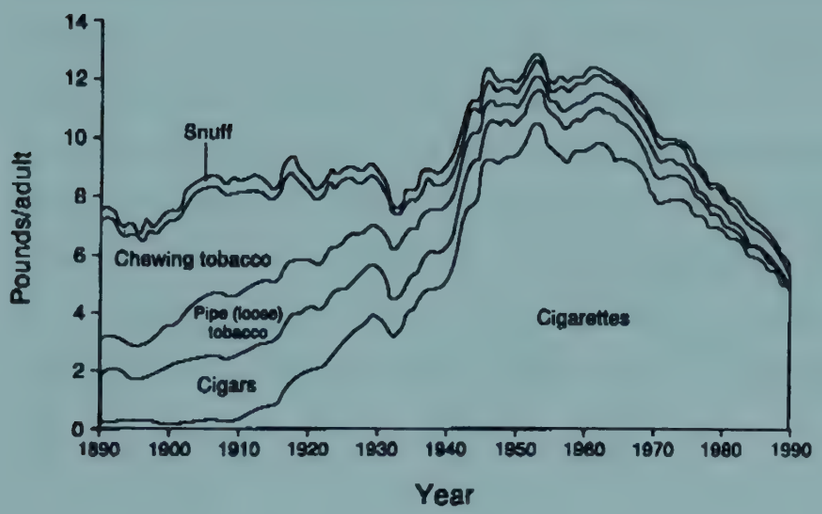

Figure 26.4B. Trends in tobacco consumption in the United States from 1890–1990, from: Bartecchi CE, MacKenzie TD, Schrier RW. The human costs of tobacco use. (First of two parts) New Engl J Med 1994;330,907, with permission.

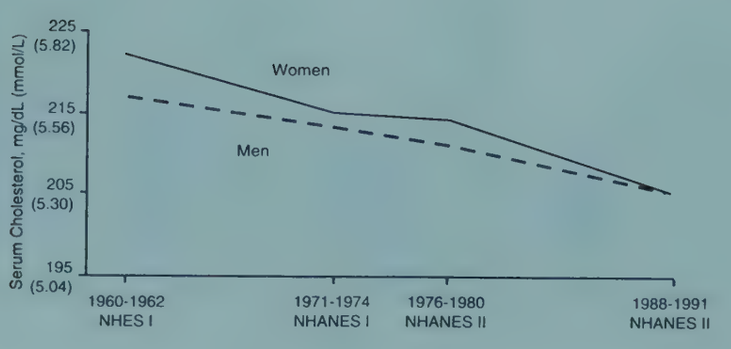

Figure 26.4C. Age-adjusted mean serum total cholesterol levels in the United States. From: Johnson CL, Rifkind BM, Sempos CT et al: Declining serum total cholesterol levels among US adults: the National Health and Nutrition Examination Surveys. JAMA 1993;269:3002, with permission.

remembered that during this time period, the food and tobacco industry consumed resources that were vastly superior to those of the community studies in their efforts to promote high fat foods and tobacco products to the American people.

There will always be those who believe that the association between high fat diet, smoking, blood pressure, physical activity and heart disease is mere coincidence. Others will continue to doubt that the community studies contributed to the declines in heart disease death rates in the United States and Finland. We don't have the resources to conduct definitive trials (Salonen 1986), and it could be argued that the strategy of selecting equivalent communities for intervention and control units in a randomized trial will in itself guarantee failure to show a difference: The behaviours that generate heart disease are socially acquired, and by definition, communities must share the same social communication networks to be equivalent. It two communities are truly equivalent, their communication channels cannot be segmented, and if the communication channels of two communities can be segmented, they are by definition not fully equivalent.

Because heart disease prevention is a public policy issue, we are forced to make a decision. The best decision is one that relies on currently available evidence. The evidence from the North Karelia Project and from the United States, while not perfect, is very good evidence that heart disease can be prevented through community action.

REFERENCES

American Heart Association. Diet and Coronary Heart Disease. Dallas, American Heart Association 1978.

Bartecchi CE, MacKenzie TD, Schrier RW. The human costs of tobacco use. (First of two parts). New Engl J Med 1994;330:907.

Blackburn H, Luepker R, Kline FG, Bracht N, Carlaw R, Jacobs D, Mittelmark M, Stauffer L, Taylor HL. The Minnesota Heart Health Program: A research and demonstration project in cardiovascular disease prevention. In Ma-

tarazzo JD, Weiss SM, Herd JA, Miller NE, Weiss SM (Eds.) Behavioral Health: A Handbook of Health Enhancement and Disease Prevention. New York: John Willey and Sons, 1984, pages 1171–1178.

Burke GL, Sprafka JM, Folsom AR, et al. Trends in CHD mortality, morbidity and risk factor levels from 1960 to 1986: the Minnesota Heart Survey. Int J Epidemiol 1989;18(Suppl 1):S73.

Carleton RA, Lasater TM, Assaf A, Lefebre RC, McKinlay SM. The Pawtucket Heart Health Program: I. An experiment in population-based disease prevention. Rhode Island Med J 1987;70:533–538.

Carleton RA, Lasater TM, Assaf AR, Feldman HA, McKinlay SM. The Pawtucket Heart Health Program: Cross-sectional results from a community intervention trial. In: Abstracts of the 34th Annual Conference on Cardiovascular Disease Epidemiology and Prevention. Dallas, Texas; American Heart Association, 1994, page 1.

Farquhar JW, Maccoby N, Wood PD et al. Community education for cardiovascular health. Lancet 1977;1:1192–1195.

Farquhar JW. The community-based model of life style intervention trials. Am J Epidemiol 1978;108:103–111.

Farquhar JW, Fortman SP, Maccoby N et al. The Stanford five-city project: design and methods. Am J Epidemiol 1985;1122:323–334.

Farquhar JW, Fortman SP, Flora JA et al. Effects of communitywide education on cardiovascular disease risk factors. The Stanford five-city project. JAMA 1990;264:359–365.

Hulley SB, Walsh JMB, Newman TB. Health policy and blood cholesterol. Time to change directions. Circulation 1992;86:1026–1029.

Johnson CL, Rifkind BM, Sempos CT et al. Declining serum total cholesterol levels among US adults: the National Health and Nutrition Examination Surveys. JAMA 1993;269:3002.

Keys A. Seven Countries. A Multivariate Analysis of Death and Coronary Heart Disease. Cambridge, Harvard University Press, 1980,

Luepker RV, Murray DM, Jacobs DR et al. Community education for cardiovascular disease prevention: risk factor changes in the Minnesota Heart Health Program. Am J Public Health, in press.

National High Blood Pressure Education Program. 20 Years of Achievement. Bethesda, Maryland: National Heart, Lung, and Blood Institute, 1992.

Rocella EJ, Burt V, Horan MJ, Cutler J. Changes in hypertension awareness, treatment, and control rates. 20-year trend data. Ann Epidemiol 1993;3:547–549.

Salonen J, Kottke TE, Jacobs DR, Hannan PJ. Analysis of community-based cardiovascular disease prevention studies-evaluation issues in the North Karelia Project and the Minnesota Heart Health Program. Int J Epidemiol 1986;15:176–182.

Slattery ML, Randall DE. Trends in coronary heart disease mortality and food consumption in the United States between 1909 and 1980. Am J Clin Nutr 1988;47:1060.

The Expert Panel. Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Arch Int Med 1988;148:36–69.

Thorn TJ, Epstein FH, Feldman JJ, Leaverton PE, Wolz M. Total mortality and mortality from heart disease, cancer, and stroke from 1950 to 1987 in 27 countries. Highlights of trends and their interrelationships among causes of death. Bethesda, MD; National Institutes of Health, NIH, Publication Number 92–3088, 1992.

Vartiainen E, Puska P, Pekkanen J, Tuomilehto J, Jousilahti P. Changes in risk factors explain changes in mortality from ischaemic heart disease in Finland. Brit Med J 1994;309:23–27.

27. GENERAL DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

Pekka Puska

1. BACKGROUND

The following are examples of the numerous letters we received from people in North Karelia at the beginning of the project:

"I want to tell you more about heart disease in my family. My mother died suddenly of heart disease at 65 years of age. My father had several heart attacks, but with regular treatment he managed to survive to nearly 80. My brother died of a heart attack at 52 years. My eldest sister has had two attacks, and my younger sister also has heart problems. I hope this information helps you in your research."

"With great sorrow and longing I want to inform you that my husband died on ... of a heart attack. So everything is too late for him. Many thanks to you. With regards."

"This project is a matter of the heart to me, because my husband died of a heart attack. He had one five years ago, followed by two more; the third one took him. He was a heavy smoker, which certainly contributed to it and damaged his heart. I hope that this project can bring understanding and help to many, so that people do not have to lose their health at their best age. With heart-felt wishes."

"Honourable doctors. This disease has been our family curse for 13 years. My husband was then 32 years and I 30. We had three daughters. Now I feel that it is hundred years since then.....People always ask how my husband is, but nobody asks how I manage. I have to carry on, be happy and take good care of everything. All this sorrow, worry, lack of money, many other things I cannot tell about - I often wonder why this life was given to me. There are certainly many of us in the same boat, but that does not comfort me.... With respect."

"Your letter arrived at a place where the father of the family died recently of heart infarction. Four of his brothers are known to have died of the same disease. My husband was 44 years. Myself, I suffer from high blood pressure. I have had it for about 4–6 years. Nowadays I already have chest pain attacks, although the nitro tablets help. I have three young children. What else can I do for them than to teach them good nutrition, encourage physical activity, etc. Please advise me if you can, because I also come from a family with much heart disease. I could at least build my children's life on healthier ground. How to do it, I don't know. I would be grateful for your advice."

The whole thing could have happened elsewhere – just the names and disease would be different. So what made North Karelia unique?

Information for a start. As the study findings accumulated it began to dawn on the people of the area that while there was an unusual problem in Finland generally, it was clearly worse in North Karelia. They began to realize that it was not a normal part of the aging process to develop chest pain on effort before reaching 50 years of age, and to have to use nitro tablets. And they began to believe there might be something that could be done about it.

The activities subsequently set in motion in North Karelia were not totally unique in Finland's history. In the early decades following Finnish independence – the 1920s and 30s – Finland was faced with severe public health problems due to infectious diseases, which were in turn related to poverty, bad housing conditions, poor hygiene, and the lack of health services. The great tuberculosis epidemic of the time was a major killer, much feared by the public.

A major action was launched to fight tuberculosis. The mass epidemic called for mass action, including general educational messages, a variety of lay activities, work by public health nurses in the local villages, mass screenings, setting up treatment and rehabilitation centers, etc. Community awareness and involvement, and the participation of the people themselves were crucial dimensions in the success achieved.

These decades were followed by the hardships of World War II and then by years of severe postwar difficulties. Only during the 1950s and 60s did the national economy really pick up speed and the standard of living start to rise. The public health problems of the infectious diseases receded, clinical medicine developed apace and health services

expanded. Greatly improved public health was the widespread perception; chronic diseases were seen as a consequence of aging, with provision of curative and rehabilitative services the appropriate response of a welfare state.

Today in Finland, as in most other industrialized nations, chronic non-communicable disorders, notably cardiovascular diseases and cancer, are responsible for most of the early mortality and disability. But at the same time we understand much more about their causes. They are not natural consequences of aging, but results of pathological processes induced by our lifestyles and environments. We already possess sufficient information to vastly reduce the burden of chronic disease in the industrialized world, as well as to prevent the developing countries from having to suffer these same epidemics. Unfortunately, there are already ominous signs of the familiar trends in many developing countries.

In spite of the obvious differences between the infectious communicable and the chronic non-communicable diseases, epidemics of both kinds of disease are deeply rooted in the prevailing cultural, social, and physical environment. So whilst the old public health maxim of 'dealing not only with the agent but also with host and environment' evolved for the infectious diseases, it also holds for today's non-communicable health problems.

Notwithstanding the remaining uncertainties surrounding the etiology of our major chronic diseases, a number of obvious causal risk factors are identifiable, and many of them are common to several diseases. Because most people are at some risk, successful prevention necessarily involves large segments of the population. The majority of the measures needed relate to lifestyle modifications that are safe and that promote health in general. The fact that risk-related lifestyles are a part of general day-to-day living and the local environment means that community-based integrated action is called for.

These was one overriding factor behind both the inception of the North Karelia Project and its successful outcome – an absolute determination on the community level to tackle this cardiovascular disease problem of literally epidemic proportions.

The approaches used and the experiences gained are described in the earlier chapters. The overall outcome of the project has certainly been positive, with major successes being achieved. Nevertheless the

problem is still with us and still large: high cardiovascular mortality persists throughout Finland. So although our successes so far have saved countless lives, suffering and money, the problem is far from solved. Moreover, the burden worldwide is large and steadily growing. So it is important for our work here to continue, not only for our own benefit, but also as part of Finland's on-going contribution to global health.

2. EVALUATION QUESTIONS

The evaluation principles applied in the North Karelia Project are described earlier. High-quality, comprehensive evaluation was a central theme from the start. This was regarded as vital if we were to gain experience for national and international use, as well as broadening our knowledge about the possibilities of preventing chronic diseases in real life. In addition, high-level evaluation research was considered important for the credibility and continued support of the project.

When the North Karelia Project was planned and launched, prevention efforts in the field of CHD were relatively new. Developments had just reached the stage of proceeding from prospective epidemiology to the start of multifactorial trials.

Launching a community-based "trial" or "intervention programme" was quite a new idea and a pioneering task. Many of the intended approaches had still to be developed, not least in the area of evaluation.

The use of the formal "matched" reference area was problematic, even during the initial five-year period, for reasons mentioned earlier. The project later became actively involved with developments on the national scale, and there can be little doubt that it has contributed significantly to the remarkable decline in CVD rates across Finland. From the opposite perspective, the national 'readiness', social demand and supportive policies have helped the project to its successes.

Thus have developments in North Karelia and all Finland been intertwined in complex ways. This is one reason why in later years the main monitoring activity has been focused on North Karelia on one hand, and all Finland on the other. It has also been justified by the overall project aim of contributing to the development nationwide. The evaluation and monitoring systems designed more than 20 years ago for the

North Karelia Project have evolved into a national monitoring system for chronic diseases and their determinants.

During the past two decades much has been written on the evaluation principles, with evaluation issues being discussed by the project team and others. There are clearly two distinct types of emphasis or perspective.

One is to see and develop these projects as "community intervention trials". Here the emphasis is on rigorous effect evaluation. Ideally this would involve random allocation of numerous communities. The other perspective puts more stress on genuine community organization and on process-related issues in the intervention and evaluation. While a study applying random allocation of several large communities is seldom feasible anyway, it may also contradict the true nature of community organization.

In the case of the North Karelia Project a quasi-experimental study design was applied, with the intention of creating a balanced mix of the two approaches. The aim was to describe, monitor and analyze developments in the most reliable ways available and from many perspectives, including strict epidemiological approaches and various quantitative and qualitative aspects of the process.

Rigorous methods have been applied to gain a broad and valid picture of the changes – those related to the objectives and others – that have occurred over the years in North Karelia. A variety of aspects and indicators of possible effects and process factors have been monitored to better understand the change process.

This kind of process evaluation has additionally provided some insight into the determinants of change and how to attribute such changes to the various intervention activities. Analyses are presented in this book that also assess the extent to which CHD mortality changes can be attributed to the alterations in the observed population risk factor profile.

3. A LEADERSHIP OF PARTNERS

Leadership in the North Karelia project has always been based on partnership. While on one hand the project was sparked by the citizens' petition to prevent heart disease and improve health in North Karelia, it

	Advocacy & Empowerment	Planned change/ Social Marketing	Balanced approach
Theorist	Illich	Skinner	Bandura
Examples of practitioners	Alinsky, McKnight, Minkler	Farquhar, Maccoby, Blackburn	Puska, McAlister
Direction	Grass-roots community	Public Health Agency	Agency with advice from grass-roots, gradual transfer of ownership
Typical goals	Environmental change	Behavior change	Lifestyle and environmental change
Concerns	Wide-ranging problems, eg. to services for addiction, homelessness, unemployment	Narrowly defined objectives specific service utilization and defined behaviors eg. contraception use	Immediate attention to narrowly defined primary goals and objectives, followed by careful selection of broader problems to address based on the significance of their impact on primary goal and their amenability to change
Means of change	Increasingly decentralized control of overall service organization and resource allocation	Communication and social influence campaigns, specific policy modification	Maximum community participation in communication and social influence campaigns for specific behavioral objectives followed by gradual empowerment for selected advocacy objectives
Types of data	Mostly subjective and	Mostly objective and quantitative	Quantitative & qualitative
Sources of concepts	Local opinion, experience	Theory, empirical studies	Theory, literature, local experience and opinion
Evaluation	Mostly subjective	Mostly objective	Objective and subjective
Usual outcomes	Long term, hard to measure	Medium term, measurable	Medium term, measurable with possibility of long term ownership/ institution-alization and impact on broader issues

Figure 27.1. Balanced model of leadership in community health programme, as defined by McAlister & Puska

was the project leaders and experts who acted collectively as the change agent, showing the community how to achieve the objectives that the people had themselves set.

Thus the North Karelia project had a mixed model of leadership. This contrasts with free community movements on one hand (numerous examples in the environmental field), and on the other with the majority of academic projects, which are carefully designed and directed from above using skilful behaviour modification techniques (Figure 27.1). The North Karelia Project has always been an enterprise that the local people have been proud of and felt part of. Over the years, "I am in the North Karelia Project" has been said and heard so often that it is firmly installed in local folklore!

The project director and central project team have always formed a visible leadership that people could clearly identify with and support. And their support has come in many ways. The strength of the partnership model is also demonstrated by the numerous initiatives and activities that took place over the years.

A central underlying principle from the very start of the programme was that the project itself would not carry out the activities, but that they would be performed by the various bodies and sectors of the community. Thus local health services, for example, have featured strongly in the activities. Both of the two provincial medical officers over the 20 year period were leading figures and effective activators, as were many of the head physicians of the health centers. The public health nurses have frequently been active participants and leaders in their own project related activities.

Several major voluntary organizations have been enthusiastic contributors to the project. The powerful housewives' organization (Martta) carried out major campaigns for a healthy diet in collaboration with the project. There were similar examples with sports organizations, heart associations etc, as well as with local food manufacturers and storekeepers. Many companies picked up useful business ideas, and initiated development, production and marketing activities for healthier foods in collaboration with the project.

In the field of agriculture the local berry and vegetable farmers eagerly allied themselves with the project. These cooperative efforts took the form of projects for promoting the consumption of local berries and vegetables. The resultant success has meant that dairy farmers, under pressure from the declining consumption of dairy fat, have been able to switch to the more promising business of berry farming. Over the years the local media (newspapers and radio) have publicised many initiatives that have grown into major collaborative efforts involving the project.

The principles of partnership and leadership has been maintained throughout. The central project leadership still carefully scrutinizes the evaluation results and feedback, and is in daily contact with the community to guide the overall development. Within this framework various community bodies themselves carry out activities; innovation is encouraged and new ideas are often realized after consultation with the central project office.

4. HEALTHIER NORTH KARELIA – HEALTHIER FINLAND

The original petition in North Karelia called for "urgent major assistance in reducing the record high burden of cardiovascular diseases in the area". As explained earlier, the original project was formulated and implemented by a project organization that involved the collaboration of various local community leaders and national experts, as well as a number of international experts (particularly from WHO).

Because the classical risk factors seemed to explain much of the high incidence, reducing their occurrence was an obvious intermediate task. But as these risk factors were tied to general lifestyles in the region (particularly dietary habits and smoking) along with their community determinants, the initial strategy was for a comprehensive community-based intervention drawing on the people's own initiatives and efforts to change lifestyles appropriately. So the aim was to "change North Karelia", rather than targeting a specific group(s) of individuals.

It was obvious and clearly articulated at the start that any success in this venture would result not only in reduced cardiovascular rates, but also in lower overall chronic disease rates and improved health of the population. It was also felt that a community-based project featuring practical services close to the people and often dependent on their participation would provide positive support to a community much stressed by the fear of cardiovascular disease and social problems. "Heart disease is not an inevitable burden of the population, and we can do something positive about it".

The project has proceeded in five-year periods, with the respective summative evaluations and planning phases. After the initial period the project became actively involved with national chronic disease prevention and health promotion – partly on the wishes of the government, and partly to reinforce the maintenance of progress in North Karelia. Within North Karelia the scope of the project gradually expanded in line with the revisions of its objectives.

Reduction of heart disease, although still a major target, is now supplemented by the more general objectives of integrated prevention of major chronic diseases (those sharing common risk factors and involving similar lifestyle changes and health promotion activities) and of

promotion of the population's health. There has also been more emphasis on preventing risk factors and promoting health in childhood, as well as among the expanding elderly population.

All this has been a great learning process for the community. Initially the people called in medical experts to help prevent heart disease, but they have gradually come to understand that successful prevention is really dependent on their own attitudes, decisions and actions. The lifestyles needing to be changed are not only aspects of individual lives, but also very much determinants of various features in the community. These realizations have breathed more life into a number of activities by community organizations as well as certain lifestyle innovations.

Qualitative evaluation by various methods reinforces the conclusion that a wholesale shift has taken place in North Karelia towards healthier lifestyles. From the innovation diffusion point of view lifestyle innovations have progressed far and been associated with profound changes in the province's social, cultural, physical, political and economic environment.

The direct costs of project implementation have always been kept at modest levels because of the principle that the project should be carried out by the community itself. Central project resources have only been used for catalyzing the development, for coordination, for launching certain central media activities and for supporting various collaborative efforts.

The bulk of project activities are associated with normal community activities or with activities that changed because of project needs. The preventive activities have been incorporated systematiclly into the health services without substantial extra costs. Voluntary organizations carry out project tasks in the context of their own work, while food manufacturers and stores are motivated by their business interests. Legislative and other environmental changes do not basically involve costs. The extensive media coverage enjoyed by the project (e.g. the national TV series) has always been financed by the media themselves.

Enormous health improvements have taken place in North Karelia. The evidence shows that over the project period cardiovascular and cancer rates in North Karelia have fallen dramatically. The age-adjusted mortality from coronary heart disease among middle-aged men has fallen

by over 60 % and that of all cancers by about 50 %. Major changes took place in the target risk factors and lifestyles, particularly in the 70s and then again during the last few years.

Mirroring the risk factor and behaviour changes, the decline in cardiovascular mortality in the 70s was significantly greater in North Karelia than in all Finland, where major decline started only in the late 70s. The decline in cancer mortality in the 80s was also significantly greater in North Karelia than elsewhere. Subjective health among North Karelians in the 1970s improved more than elsewhere, and there has been a marked improvement in general health status in North Karelia. It is also obvious that this major national demonstration project in North Karelia

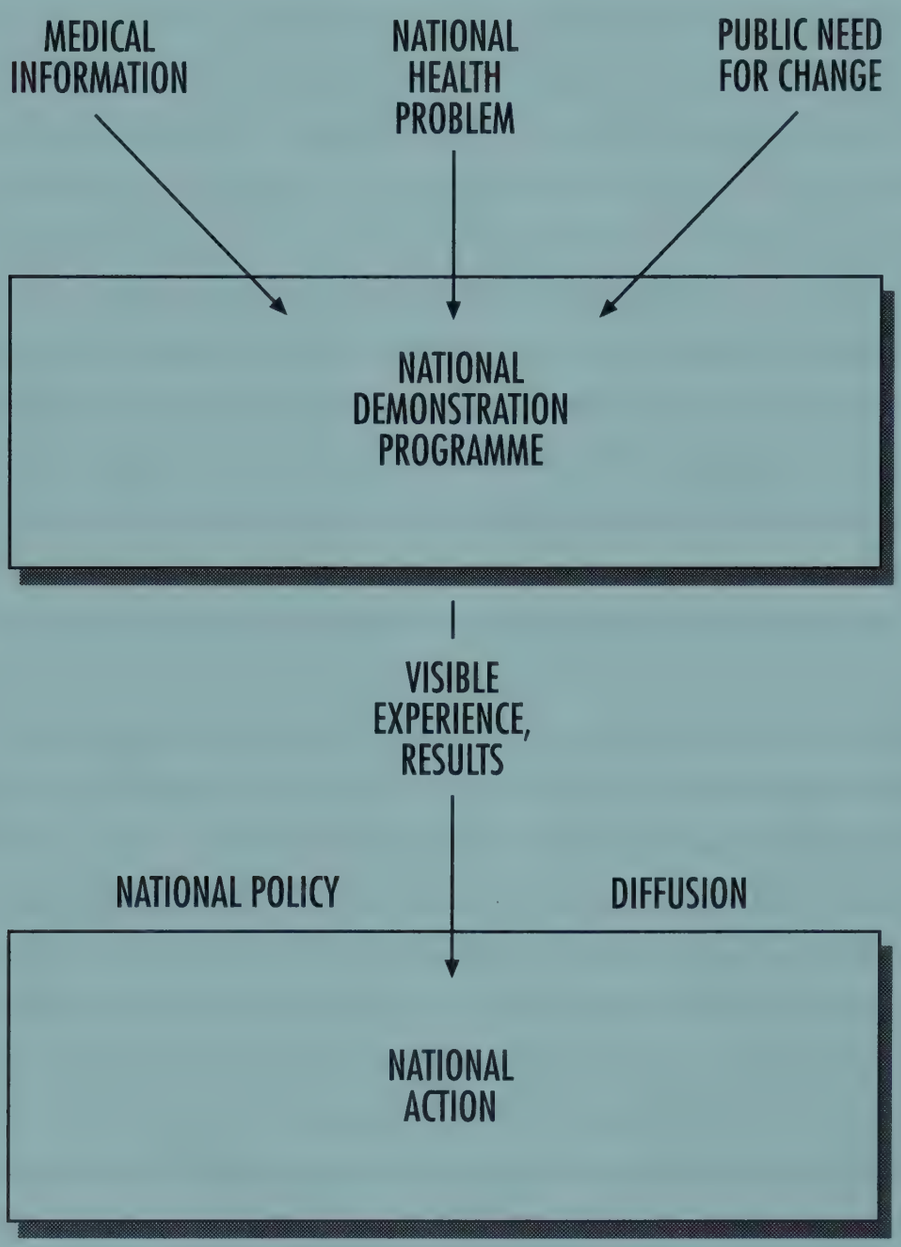

Figure 27/2. Overall use of national demonstration programme

has proved a powerful tool in the substantial health improvements observed on the national level, as was initially intended.

Figure 27.2. illustrates the overall use of the North Karelia Project as a national demonstration programme. With relevant medical information and resources and the expressed public desire for change, the big national health problem was initially tackled using a carefully designed and evaluated demonstration programme. This, in turn, has given valuable information on the potentials for prevention and health promotion in the society concerned. The practical findings and visible experiences have then guided the applied activities that have spread across the country through the general diffusion of ideas and national policy decisions. Reduction of CVD mortality in Finland cluring the last 15 years has been one of the most rapid in the world.

5. RECOMMENDATIONS

The following recommendations are made, based on the theoretical consideration presented and on the results and experiences in North Karelia:

- Integrated community-based chronic disease prevention and health promotion programmes should adhere to the well - established principles and rules of general programme planning, implementation and evaluation.
- Community-based preventive programmes should utilize the appropriate medical/epidemiological frameworks for selecting the intermediate objectives, and the relevant behavioural/social theories for designing the actual intervention programme.
- Essential elements of a successful community intervention programme are a sound and comprehensive understanding of the community ("community diagnosis") as well as close collaboration with various community organizations and full participation by the local people themselves.
- Community-based intervention programmes need to combine well-planned media and other messages with broad-ranging community activities involving sectors such as primary health care, voluntary organizations, food manufacturers and supermarkets, worksites and schools, the local media etc.

- Community-based preventive programmes should cultivate the collaboration and support of both formal community decision makers and informal opinion leaders.
- Successful community-based intervention programmes need to amalgamate sound theoretical frameworks with dedicated persistence and hard work, and with close day-to-day interactions with the community.
- The major emphasis and resources of a community intervention programme should be directed at modifying social and physical environments in the community to become more conducive to health and healthy lifestyles.
- An essential component of all community programmes, and especially of national demonstration projects, is a system of reliable and first-rate monitoring and evaluation, both for continuous follow-up of the change process and for more comprehensive summative evaluations.
- Major community intervention programmes can be beneficial not only for the target community, but also in the broader context by serving as national demonstration programmes. This requires close cooperation with the national authorities for the dissemination of experiences and evaluation findings etc.

6. CONCLUSIONS

The three main conclusions to be drawn on the basis of twenty years of experience with the North Karelia Project are:

1. A comprehensive, determined and theory-based community programme can have a substantially positive effect on risk factors and lifestyles.
2. Such developments are associated with correspondingly favourable changes in chronic disease rates and population health.
3. A major national demonstration programme can be a powerful tool for generating favourable nationwide developments in chronic disease prevention and health promotion.

VI

Summary

Summary

The North Karelia Project began in the early 70s in response to a petition from the local people for urgent help to reduce the extremely high levels of heart disease in this eastern province of Finland. The initiation of such a large, ambitious and pioneering project also reflected the growing concern felt throughout the country and the need for concerted nationwide action.

The project launch in 1972 followed a planning process involving Finnish experts along with representatives of North Karelia and the World Health Organization. The planning work took account of emerging information on the strongest and most likely causal risk factors and their relationships with community lifestyles. Because of the high prevalence of these risk factors in the North Karelian population (especially men), the central approach adopted was community-based prevention. This meant aiming at general improvements in the risk factor profile of the population via a comprehensive intervention involving all sectors of the community, and notably the citizens themselves.

The main target risk factors were smoking, elevated serum cholesterol and elevated blood pressure. Most of the emphasis was on influencing the dietary and smoking habits of the population. A decrease in the high saturated fat intake and a relative increase in unsaturated fat consumption were central goals of the dietary interventions. Over the years, attention has also been directed at the issues of physical activity, overweight, diabetes, alcohol consumption and psychosocial factors.

The Finnish national health authorities decided right from the outset that North Karelia would act as a pilot for all Finland. The original project period was five years, from 1972 to 1977. The methods adopted included general health education (materials, media activities, meetings, cam-

paigns etc.), measures incorporated in local health services, training of personnel groups, encouraging environmental changes (smoking restrictions, collaborating with food manufacturers and grocery chains, promoting vegetable growing etc), and monitoring the outcomes.

It has been the central role of the project to stimulate and catalyze a series of positive health developments in North Karelia, through expert advice, activity coordination, media information, material and training, direct community contacts and other forms of facilitation, and by evaluative and other research. However, most of the practical aspects of the intervention have actually been carried out by various bodies within the community.

It was considered worthwhile for the project to continue operating beyond the initial five-year period, but at the same time to expand activities to contribute to national developments. So while North Karelia continued to be an active demonstration area the project evolved a national dimension to its activities. The scope of the project was also gradually expanded. The first youth projects started in the late 70s to help minimize the emergence of risk factors in childhood and adolescence. In the early 80s, and coinciding with the corresponding developments at WHO, the project became increasingly committed to a more integrated approach to the prevention of major non-communicable diseases and health promotion.

The national dimention of the North Karelia Project was facilitated by the relocation of its coordinating centre in 1980 from the University of Kuopio to the National Public Health Institute (KTL) in Helsinki. This not only assisted the provision of on-going support to the evaluation and intervention activities in North Karelia, but also the numerous applications on the country-wide level, eg. national chronic disease prevention and health promotion activities, and the development of national monitoring systems for disease, risk factors and health behaviour trends.

Over the years project intervention has increasingly involved a spectrum of innovative health promotion activities, e.g. various collaborative campaings, competitions for smoking cessation and cholesterol reduction, environmental and structural changes (eg. the berry project), collaboration with the food manufacturing industry, and national policy decisions (eg. anti-smoking legislation).

It was decided at the outset that careful and scientifically sound evaluation would have to be an essential feature of the project. The goal was to build up a comprehensive picture of the results, changes and consequences of intervention activities. Evaluation has been particularly concerned with the 1) feasibility (input, performance) of the intervention, 2) changes and effects on target risk factors and related behaviours, and on CVD and other major NCD rates, 3) change process factors, and 4) cost aspects related to the prevention and health promotion work.

For the original project period the neighbouring province of Kuopio was chosen as a matched reference area. Since the project activities became largely nationwide in scope, developments in North Karelia and all Finland have both been monitored. In fact, the disease, risk factor and health behaviour monitoring systems initially developed to evaluate the North Karelia Project have evolved into a national monitoring system.

Changes in risk factors have been assessed by careful examination of independent, cross-sectional population samples in North Karelia and alsewhere at five year intervals. In these surveys the risk factor measurement methods have been carefully standardized. The age group common to the present analyses includes the 30–59-year-olds. Modifications in health behaviours and their change process have been further scrutinized via annual mail surveys of independent samples, first in North Karelia alone and since 1978 also in all Finland (National Health Behaviour Monitoring System). Changes in disease rates have been monitored by analysing data from official mortality statistics and from special WHO-related acute myocardial infarction and stroke registers in North Karelia and other monitoring (MONICA) areas.

The chapter on risk factor changes (chapter 6) presents the changes in target risk factors in North Karelia and elsewhere. The changes over 20 years have been substantial: in men, smoking has declined from 52 % to 32 %, mean serum cholesterol from 6.9 mmol/l to 5.9 mmol/l (15.5 %) and blood pressure from 149/92 mmHg to 142/85 mmHg (4.8 %/8.0 %). The decline in smoking in 1972–82 and in serum cholesterol and blood pressure in 1972–77 was significantly greater in North Karelia than the original reference area. In women, smoking increased slightly but persisted at a low level. Serum cholesterol and blood pressure levels have declined even more among women than men.

Death rates from coronary heart disease, and from cardiovascular disease generally, have fallen dramatically from the pre-programme period (1969–71): by 1992 the coronary heart disease mortality for men was 59 % lower (preliminary data for 1994 show a 65 % lower level). CHD mortality in the 70s fell significantly more in North Karelia than in the original reference area and all Finland. Thereafter, all Finland has caught up with this development, although the decline has accelerated in North Karelia, too. The trends in stroke and all CVD mortality resemble those of coronary heart disease.

There was a falling trend in cancer mortality in both North Karelia and all Finland in the 70s, while in the 80s the decline accelerated significantly faster in North Karelia. The reduction in CVD and cancer mortality among the province's 35–64-year-old population was directly reflected in a decline of all cause mortality among men and women of about 40 % from 1969–71 to 1990–92. It can be estimated that the greatly diminished mortality over this period has prevented some 3.800 premature deaths (before 75 years) in North Karelia and about 50.000 in all Finland. The life expectancy at birth has increased from 66.4 years (men) and 74.6 years (women) in 1971 to 71.7 years (men) and 79.4 years (women) in 1992.

Later chapters provide further information on the change process in North Karelia, and also in all Finland. The analyses presented clearly indicate that the reductions in the target risk factors explain well the massive decline in coronary mortality among both men and women. The results also show that the risk factor changes have occurred in all categories of the population, although there are differences between socioeconomic groups, for example. The results of the economic analyses create an interesting picture of the economic implications of a transformation in cardiovascular mortality which has led to disease cases tending to occur much later in life than before.

The final section of the book discusses the experiences gained from a variety of different activities and from the North Karelia Project as a whole. Overall, the project has been a resounding success, although some of the ventures undertaken over the years have met with considerable constraints. The project has contributed to nationwide developments in numerous ways; over the past two decades CVD mortality has declined faster in Finland than anywhere else in Europe.

To summarize, the main conclusions from the North Karelia Project are as follows:

1) A comprehensive, determined and theory-based community programme can have a substantial positive effect on risk factors and lifestyles.
2) Such changes are associated with favourable changes in chronic disease rates and in the health of the population.
3) A major national demonstration programme can significantly enhance nationwide measures in chronic disease prevention and health promotion.

The North Karelia Project has also been active in international collaboration. At the outset the project gained much invaluable advice from abroad, especially from WHO experts. Since the early phase it began contributing to international developments in the field of NCD prevention and health promotion in many ways. Indeed, numerous community-based projects and national demonstration programmes are now underway across the globe. Such developments will ultimately assist us to control the modern epidemics of chronic diseases and teach us more about the utility of various intervention approaches in different cultural settings.

DIRECTOR OF THE NORTH KARELIA PROJECT

PEKKA PUSKA

Heart disease and other forms of chronic illness are the major public health problems throughout the industrialized nations, and they are already raising serious concerns in many areas of the developing world. In 1972, Finland responded to alarming heart disease mortality rates by launching an ambitious national demonstration project – the North Karelia Project – with the aim of implementing a comprehensive, community-based programme to substantially reduce heart disease mortality.

The North Karelia Project has achieved remarkably successful results and provided a model for numerous similar projects around the globe. The lifestyles of countless people are now healthier, risk factor levels are lower and heart (and other) disease rates greatly diminished. In this book the project team´s researchers describe the methods employed, present the results and discuss the experiences generated during the 20 years of this pioneering project.

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North Karelia Project

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